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MMS 86-0023

Alaska Summary Report

June 1984 - December 1985

Outer Continental Shelf Oil and Gas Activities
in Alaska and their Onshore Impacts

Outer Continental Shelf Oil and Gas Information Program
U.S. Department of the Interior Minerals Management Service

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Arctic Subregion Summary Reports and Updates

- Outer Continental Shelf and Onshore Oil and Gas Activities and Impacts in the Arctic: A Summary Report. Joanne Barnes Jackson, B. Fritts Golden, Anne Stadnychenko, and Sharon Kolasinski. October 1981. USGS Open-File Report 81-621, U.S. DOI, 137 p.
- Update 1, Outer Continental Shelf and Onshore Oil and Gas Activities and Impacts in the Arctic: A Summary Report, October 1981. Joanne Barnes Jackson and Barbara Cushmore Pretz. May 1982. USGS Open-File Report 82-19, U.S. DOI, 76 p.
- Arctic Summary Report, Outer Continental Shelf Oil and Gas Activities in the Arctic and their Onshore Impacts. Joanne Barnes Jackson and Frederick N. Kurz. January 1983. U.S. DOI, 81 p.
- Arctic Summary Report Update, September 1983, Outer Continental Shelf Oil and Gas Activities in the Arctic and their Onshore Impacts. Jeffrey L. Deis and Robert Pierson. September 1983. U.S. DOI, 58 p.
- Arctic Summary Report. Christopher B. Lynch, Douglas S. Slitor, and Robert W. Rudolph. January 1985. OCS Information Report, MMS 85-0022, U.S. DOI, 84 p.

Bering Sea Subregion Summary Reports and Updates

- Bering Sea Summary Report, Outer Continental Shelf Oil and Gas Activities in the Bering Sea and their Onshore Impacts. Jeffrey Deis, Robert Pierson, and Frederick Kurz. September 1983. U.S. DOI, 81 p.
- Bering Sea Summary Report, Outer Continental Shelf Oil and Gas Activities in the Bering Sea and their Onshore Impacts. Jeffrey Deis. September 1984. OCS Information Report, MMS 84-0076, U.S. DOI, 84 p.

Gulf of Alaska Subregion Summary Reports and Updates

- Outer Continental Shelf Oil and Gas Activities in the Gulf of Alaska (including Lower Cook Inlet) and their Onshore Impacts: A Summary Report. Joanne Barnes Jackson and Richard T. Dorrier. September 1980. USGS Open-File Report 80-1028, U.S. DOI, 78 p.
- Gulf of Alaska and Lower Cook Inlet Summary Report 2, A revision of Outer Continental Shelf Oil and Gas Activities in the Gulf of Alaska (including Lower Cook Inlet) and their Onshore Impacts: A Summary Report, September 1980. Karen M. Collins and Anne Stadnychenko. June 1981. USGS Open-File Report 81-607, U.S. DOI, 69 p.
- Gulf of Alaska and Lower Cook Inlet Summary Report 3, Second revision of Outer Continental Shelf Oil and Gas Activities in the Gulf of Alaska (including Lower Cook Inlet) and their Onshore Impacts: A Summary Report, September 1980. Joanne Barnes Jackson and Frederick N. Kurz. June 1982. USGS Open-File Report 82-20, U.S. DOI, 79 p.
- Gulf of Alaska Summary Report Update, Outer Continental Shelf Oil and Gas Activities in the Gulf of Alaska and their Onshore Impacts. Joanne Barnes Jackson. April 1983. U.S. DOI, 29 p.
- Gulf of Alaska Summary Report Update, Outer Continental Shelf Oil and Gas Activities in the Gulf of Alaska and their Onshore Impacts. Jeffrey D. Wiese. May 1984. OCS Information Report, MMS 84-0030, U.S. DOI, 27 p.

Alaska Indexes

- Alaska Index (December 1976 - November 1980). Richard T. Dorrier. USGS Open-File Report 81-20, U.S. DOI, 85 p.
- Alaska Index (December 1980 - November 1981). Mary Ann Collignon. USGS Open File Report 82-18, U.S. DOI, 81 p.
- Alaska Index (December 1981 - April 1983). Mary Ann Collignon. U.S. DOI, 76 p.
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by James H. Collins
and Christopher W. Lynch

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THE OUTER CONTINENTAL SHELF INFORMATION PROGRAM

The Minerals Management Service (MMS), through its OCS Information Program (OCSIP), publishes a series of documents on oil and gas activities in each of the offshore regions of the Nation--Atlantic, Gulf of Mexico, Pacific, and Alaska. This is the first consolidated Alaska Summary Report published by OCSIP; it replaces the Arctic, Bering Sea, and Gulf of Alaska subregional summary reports previously published. This document, covering the entire Alaska OCS Region, includes all the significant issues discussed in the three previous subregional reports, while eliminating much of the overlap and repetition required when three separate reports were written.

The OCSIP also publishes a series of Alaska Indexes that list relevant, actual or proposed programs, plans, reports, environmental impact statements, and other lease sale and development information. Further, the OCSIP staff is available to answer questions and receive comments; they may be contacted at this address:

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The MMS OCS leasing and development program includes many opportunities for public comment and involvement. The summary reports prepared regularly by OCSIP provide both a review of pertinent information and a list of sources for more specific data. They may serve as reference documents for individuals interested in taking advantage of the opportunities for public discussion of development issues offshore.

U.S. Customary — International System (SI) Conversion

Measurements in this document are reported in U.S. customary units, with the exception of bathymetric mapping where ocean bottom contours and topography are cited in meters in accordance with standard usage. The following table provides conversion factors from customary to metric units.

Multiply customary units	by	to obtain SI units
feet	0.3048	meters
statute miles	1.6090	kilometers
geographic (nautical miles)	1.8520	kilometers
acres	0.4047	hectares
barrels (U.S. petroleum)	0.1589	cubic meters
cubic yards	0.7646	cubic meters
square miles	2.5900	square kilometers
long (deadweight) tons	1.0160	metric tons
inches	2.5400	centimeters

NOTE: Distances on the Federal Outer Continental Shelf and on land are measured in statute miles. Within the State-owned 3-mile limit, distances are measured in geographic miles.

Abbreviations and Acronyms

ABSORB - Alaska Beaufort Sea Oil Spill Response Body
ACMP - Alaska Coastal Management Program
ACS - Alaska Clean Seas
AEIDC - Arctic Environmental Information and Data Center
AFN - Alaska Federation of Natives
AMSA - areas meriting special attention
ANCSA - Alaska Native Claims Settlement Act
ANGTS - Alaska Natural Gas Transportation System
ANILCA - Alaska National Interest Lands Conservation Act
API - American Petroleum Institute
ASRC - Arctic Slope Regional Corporation
BBO - billion barrels of oil
BLM - Bureau of Land Management
bpd - barrels per day
CFR - Code of Federal Regulations
CIDS - Concrete Island Drilling System
CIRI - Cook Inlet Region, Inc.
CMP - coastal management plan
COST - Continental Offshore Stratigraphic Test
CPC - Coastal Policy Council
CRSA - Coastal Resource Service Area
CZMA - Coastal Zone Management Act
CZMP - coastal zone management program
DEIS - draft environmental impact statement
DEW - Defense Early Warning
DGC - Division of Governmental Coordination
DMRA - Division of Municipal and Regional Assistance
DNR - Department of Natural Resources
DOI - Department of the Interior
DSDP - Deep Sea Drilling Project
dwt - deadweight ton
EIS - environmental impact statement
EPA - Environmental Protection Agency
FEIS - final environmental impact statement
FR - Federal Register
FWS - Fish and Wildlife Service
GAO - General Accounting Office
ITM - Information Transfer Meeting
LNG - liquefied natural gas
LPRC - Lease Planning and Research Committee
MMS - Minerals Management Service
MP - marginal probability
NEPA - National Environmental Policy Act
NOAA - National Oceanic and Atmospheric Administration
NPRA - National Petroleum Reserve - Alaska
OCS - Outer Continental Shelf
OCSEAP - Outer Continental Shelf Environmental Assessment Program
OCSIP - Outer Continental Shelf Information Program
OCSLAA - Outer Continental Shelf Lands Act Amendments
OHMSETT - Oil and Hazardous Materials Simulated Environmental Test Tank
OITC - OHMSETT Interagency Technical Committee
OPD - official protraction diagram
OTA - Office of Technology Assessment
pgt - per gross ton
PRESTO - Probabilistic Resource Estimates - Offshore
RTWG - Regional Technical Working Group
SEEA - social, economic, and environmental analysis
SESP - Social and Economic Studies Program
SPORT - Spill of Opportunity Program
SSDC - Single Steel Drilling Caisson
SWEPI - Shell Western Exploration and Production, Inc.
TAGS - Trans-Alaska Gas System
Tcf - trillion cubic feet
TPU - Technical Publications Unit
Unocal - Union Oil Company of California
U.S.C. - United States Code
USGS - U.S. Geological Survey
VLCC - very large crude carrier

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Abstract

The Alaska Outer Continental Shelf Region is diverse in its physiography and geology. Many sedimentary basins with petroleum potential occur in the submerged Federal lands of Alaskan offshore areas. Current estimates of undiscovered economically recoverable resources for leased and unleased lands in the Alaska Outer Continental Shelf Region are 3.33 billion barrels of oil and 6.90 trillion cubic feet of gas. However, only a small percentage of the region has been explored to date. The present world oil surplus, in conjunction with high operating costs on the remote Alaskan offshore environment, necessitate that the reserves be considerably larger than in other regions for fields to be economically producible. In addition, technological and logistical constraints imposed by the severe Alaskan environment present difficulties for exploration, development, and transportation of these resources.

Ten lease sales and two reoffering sales have been held in the Alaska Outer Continental Shelf Region since leasing began there in 1976. Under the current 5-year leasing program issued in July 1982, seven additional sales are scheduled, and two are on hold pending expressions of interest by industry. Exploratory drilling is underway in the Navarin Basin and Beaufort Sea Planning Areas. Recently, drilling also has taken place in the Norton Basin, St. George Basin, and Cook Inlet areas, with no commercial discoveries. In the Beaufort Sea area of the Arctic, new mobile drilling platforms are being introduced, opening the way for more flexible, inexpensive, and timely drilling as operators move away from total reliance on manmade gravel islands. Mobile units in use or planned for use include the bottom-founded Concrete Island Drilling System, the Single Steel Drilling Caisson, the semi-submersible **Kulluk**, and the ice-resistant drillship **Explorer II**.

In State waters, development plans for the Seal Island discovery in the Beaufort Sea await results of delineation drilling from Northstar Island. Approximately 12 to 15 percent of the Seal Island reservoir is believed to underlie the Outer Continental Shelf. Numerous other exploration projects are underway in the Beaufort from gravel islands in State waters. The State recently held two offshore sales--one in the Beaufort, the other in the Cook Inlet. Under the State's 5-year schedule, six additional offshore sales are scheduled.

Final approval for Sohio's Endicott project, the first development in U.S. Arctic waters, was granted in January 1985; production is scheduled to begin in 1988. The project, already underway, includes a causeway extending north from shore. Two breaches were required in this gravel causeway to ameliorate the potential effects on water flows offshore and impacts on the ecosystem. Approval for a gravel causeway and island in Prudhoe Bay, part of ARCO's Lisburne development, is awaiting completion of an environmental impact statement by the U.S. Army Corps of Engineers. Work on the onshore facets of the Lisburne project is proceeding, with the first production flows anticipated in late 1986 or early 1987. Production of oil and gas from State waters continues in the Cook Inlet. A recent ruling by the U.S. Department of Commerce will allow the first export of Alaskan crude oil; approximately 6,000 barrels per day of State royalty oil is expected to be shipped to Japan.

Future strategies for transporting hydrocarbons from the Outer Continental Shelf should be influenced by numerous recent events. Review of the potential

environmental effects from the Endicott project has led to concerns over the cumulative adverse impacts of additional offshore causeways; submerged marine pipelines are expected to be used in future projects. Work on plans for the trans-Alaska gas system continues, and two efforts undertaken with Japan and Korea to study capital costs and Asian markets for natural gas from this system should be completed in the second half of 1986. A ruling by the U.S. Secretary of Transportation allowing supertankers, built for foreign trade with U.S. subsidies, to repay construction subsidies and to carry oil from Alaska to the continental United States should result in increased competition and lower shipping costs. The Alyeska pipeline transported nearly 609 million barrels of oil from the North Slope during 1984; declines in the flow are expected in 1986 or 1987. Decreased flows of Alaskan hydrocarbons may lead to far-reaching impacts on the Nation and Alaska in particular.

Scenarios for transporting hydrocarbons from Alaska Outer Continental Shelf planning areas center on marine pipelines carrying oil and gas from production wellheads to landfalls, with eventual flow to transshipment facilities in ice-free ports for loading onto supertankers and ultimate shipment to continental U.S. refineries. Only in the Navarin Basin would the expected scenario differ significantly, as the area is so far removed from any landfall. In the Navarin, tankers would be loaded directly from offshore facilities adjacent to production wells.

Shore-based support facilities may serve both onshore and offshore oil and gas operations. Marine support for current Arctic Outer Continental Shelf activities uses less than 10 percent of available dock capacity on the North Slope. In the Bering Sea Subregion, Nome is the support base for Outer Continental Shelf activity in the Norton Basin Planning Area. Marine support for Navarin Basin exploratory drilling has been based in Dutch Harbor on Unalaska Island. Air support has been provided from St. Paul Island and from Cold Bay on the Alaska Peninsula. The ports of Homer, Kenai, Seward, and Yakutat have been and probably would be used again as support bases if Outer Continental Shelf activity in the Gulf of Alaska Subregion resumes in the near future.

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Introduction

Alaska in many ways is a vast, unknown frontier. This fact is especially true in considering the Alaska Outer Continental Shelf (OCS), which makes up 54 percent of the Nation's OCS leasing area. For leasing and management purposes, the Department of the Interior (DOI) divides the Alaska OCS Region into 15 planning areas (fig. 1). Though leasing and exploratory drilling in the Alaska OCS Region began in 1976 and activity is increasing, only the surface has been scratched. Industry's ability to search these vast submerged lands has increased tremendously over the past 10 years as knowledge of the environment and technology to overcome the challenges have developed.

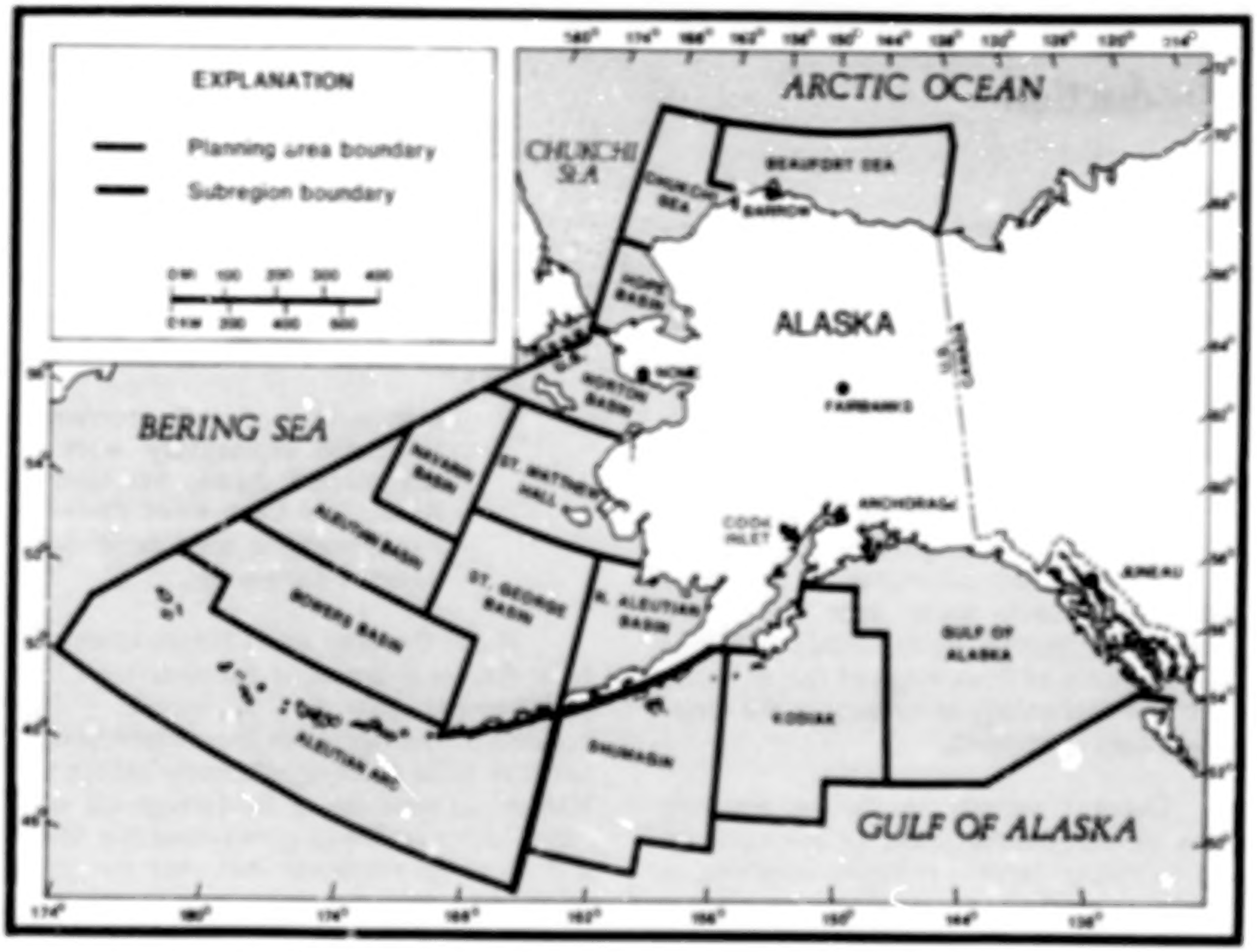
Current activity in various planning areas of the Alaska OCS, as discussed in this summary report, reflects advances in technology and environmental science, but the exploration taking place each year is giving the Nation only a limited view of the resources. The potential remains largely untested. Among the most significant recent developments in Alaskan offshore activity are the following:

- the first exploration drilling in the Navarin Basin Planning Area;
- the introduction of mobile drilling units capable of drilling during any season in the Beaufort Sea, allowing for more flexible, timely, and inexpensive exploration of submerged Arctic lands;
- delineation of the Seal Island reservoir prior to planning development of this first prospect to include Alaska OCS oil reserves;
- initiation of work on the Endicott Development Project, the first development of offshore hydrocarbons in the Beaufort Sea; and
- conclusion of all currently scheduled exploratory work in the Norton Basin, St. George Basin, and Cook Inlet Planning Areas with no announced commercial discoveries.

While the promise of future resources from Alaska is great, in the near term the development potential is unsure. Decreased production from the massive Prudhoe Bay field could significantly affect the Nation—as dependence on foreign oil supplies correspondingly grows—and the State and local governments that rely on revenues related to the flow of crude oil from Prudhoe Bay.

A number of projects to be developed in the Arctic in the near future will bring new production on line, and exploration continues in various regions. Such activity is promising and could provide secure sources of domestic hydrocarbon resources into the 21st century. The overall situation, however, is much more unsure than a simple discussion of the development projects would indicate.

The Prudhoe Bay field currently produces 1.5 million barrels per day of high-grade oil; the one unit is responsible for 17 percent of U.S. domestic production. These numbers dwarf any projections for production from current North Slope or offshore projects (fig. 2). At present, the Nation relies greatly on the massive Prudhoe reserve, but production is expected to begin declining in the next few years. Once the flow of oil from the field has



Note on Planning Area Name Changes: In the course of preparing the new 5-year OCS oil and gas leasing program, the boundaries and designations of the various OCS planning areas were reviewed. One of the decisions resulting from this review was to change the names of the Diapir Field and Barrow Arch Planning Areas in Alaska's Arctic Subregion to better associate them with their geographic locations. In this report and henceforth, the Diapir Field will be known as the Beaufort Sea Planning Area and the Barrow Arch as the Chukchi Sea Planning Area. The boundaries of these areas remain unchanged.

FIGURE 1.--Alaska OCS Region subregions and planning areas.

peaked, production rates are expected to drop off by as much as 15 percent annually.

Exploration activities continue at a strong pace, and industry predicts that for every two barrels of oil discovered in the United States in the future, one will be Alaskan oil. However, discoveries have not been made to date that might serve to adequately replace Prudhoe Bay production, even in its first few years of decline.

The information contained in this summary report is intended to present OCS-related activities that occurred between June 1984 and December 1985. However, selected data from DOI's proposed 5-year OCS oil and gas leasing program, released on February 6, 1986, have been included because of their potential significance to those planning for the impacts associated with offshore development. In all other respects, activities occurring after December 31, 1985, are considered to be out of the scope of this document.

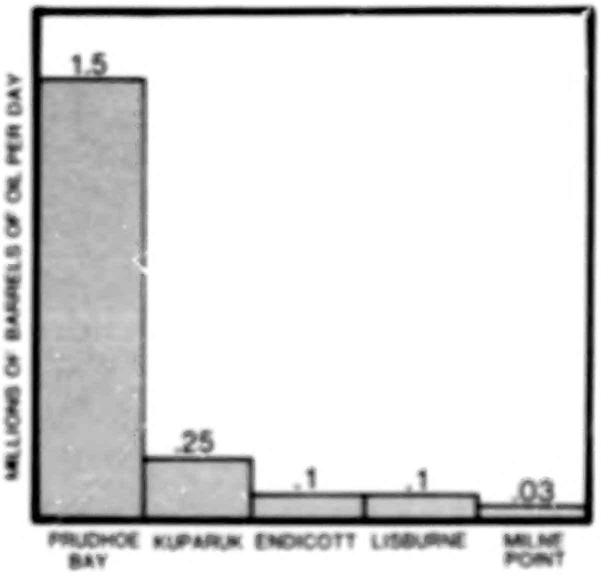


FIGURE 2.--Estimated daily oil production rates for active or proposed developments in the Alaskan Arctic.

Official Protraction Diagrams

The Alaska OCS Region is mapped on **official protraction diagrams** (OPD) using the Universal Transverse Mercator System. Each OPD covers an area of 1° latitude by 3° longitude and is divided into blocks. Alaska OPD's each bear a unique numerical designator. Individual lease blocks, the basic leasing units, are referenced by OPD and block number.

Copies of OPD's discussed in this report cost $2 each and can be ordered through the following office:

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1. Offshore Oil and Gas Resources of the Alaska Region

PHYSIOGRAPHY OF THE ALASKA OCS SUBREGIONS

The Alaska OCS Region comprises 54 percent of the total U.S. area currently being considered for future lease sales (fig. 3) (DOI, 1986). The State's 6,640-mile coastline and the complexity of the adjacent continental margins account for the diverse locations where offshore oil and gas resources may be found. Many sedimentary basins with petroleum potential are associated with the wide array of geologic processes that formed the Alaska OCS. Because of its size, the Alaska OCS Region is divided into three subregions: the Arctic, the Bering Sea, and the Gulf of Alaska. The subregions have been further divided into 15 administrative planning areas (see fig. 1, p. 2).

The following discussions highlight the regional physiographic and geologic characteristics of the three Alaska subregions. For a more comprehensive treatment of these topics, refer to the 1985 National Compendium (MMS 86-0017) available from the Outer Continental Shelf Information Program (OCSIP).

General Physiographic Aspects of the Arctic Subregion

The Alaska Arctic Subregion (fig. 4) is considered one of the most promising hydrocarbon provinces in the United States. Tests conducted both onshore and offshore indicate that much of the subregion is underlain by sedimentary rocks with potential for oil and gas deposits. The onshore discovery of large oil deposits in the adjacent Coastal Plain has intensified industry's interest in exploring the OCS.

The character of the continental shelf within the subregion is highly variable. East of Point Barrow, in the Beaufort Sea, the continental shelf is relatively narrow and grades steadily from the coastline to the shelf break. West of Point Barrow, the continental shelf underlying the Chukchi Sea is extensive and extremely flat. The flatness of the Chukchi shelf is interrupted in a few isolated locations by such topographic features as the Hanna and Barrow Sea valleys and the Hanna Shoal. To the south, Hope Basin is defined by a zone of normal faults that parallel the southern flank of the northwest-striking Herald Arch overthrust and extend to the Bering Strait. The subregion's shelf is separated from the abyssal plain of the Arctic Ocean to the north by a section of the continental slope known as the Beaufort Scarp. Steep, linear, and strongly sculpted by slumps and leveed channels in its western and central portions, the Beaufort Scarp becomes progressively wider and more even in the east. The more gentle topography of this section of the Beaufort Scarp is the result of the northward progradation of sediment from the Mackenzie Delta that lies to the east.

Onshore, the Arctic Subregion is generally divided into three physiographic provinces: the Brooks Range-Southern Foothills, the Northern Foothills, and the Coastal Plain. The latter two refer to the region known as the North Slope, an area greater than 88,000 square miles. The continental shelf north and west of the North Slope is essentially a submerged extension of the Coastal Plain province.

The Brooks Range consists of rugged, glaciated, east-trending ridges which rise to elevations of 8,000 feet. Cliff and bench topography, typical of glacially carved sedimentary rocks, characterize these mountains. South of the Brooks Range, the Southern Foothills rise to heights varying from 1,200 to 3,500 feet. These hills are characterized by irregular

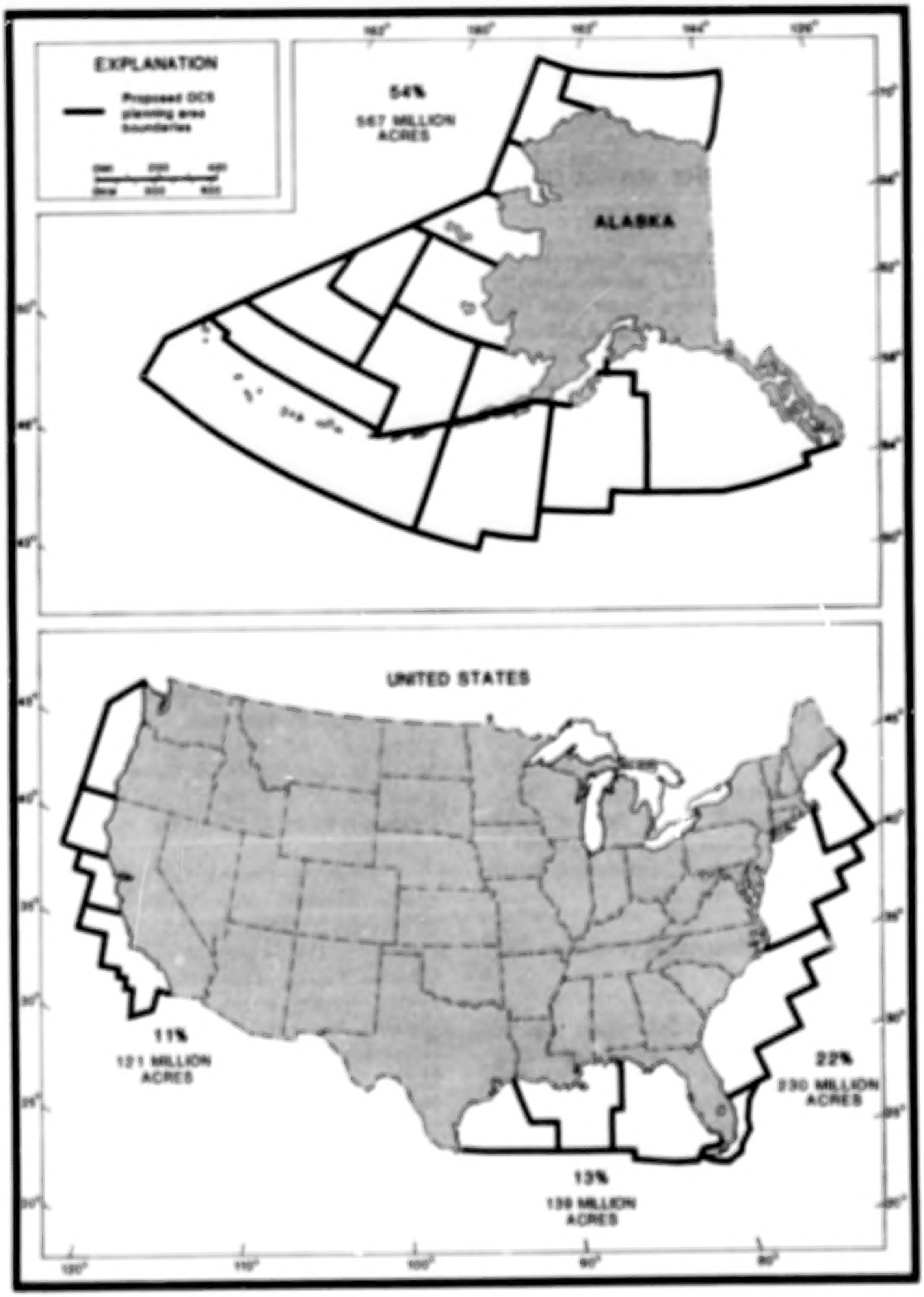

FIGURE 3.--Proposed OCS planning area boundaries of Alaska and the conterminous United States, encompassing 1,037,000,000 acres (DOI, 1986).

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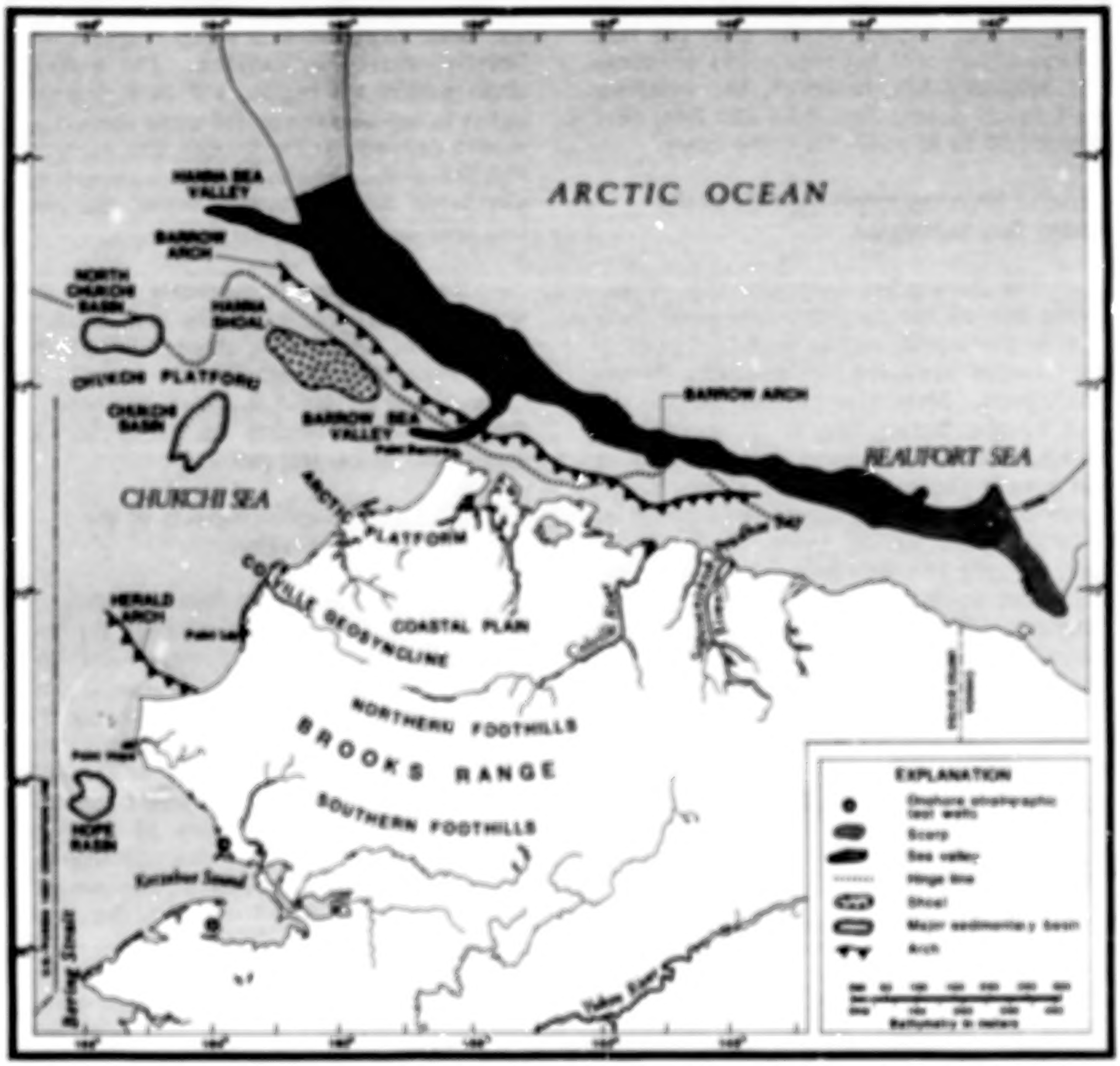

FIGURE 4.--Physiography and geology of the Arctic Subregion (adapted from National Oceanic and Atmospheric Administration, 1983; Ehm, 1983; Grantz, Reimnitz, and others, 1982; Grantz, Hunter, and others, 1982; Grantz, Barnes, and others, 1980b; Grant, Eittreim, and others, 1979).

buttes, east-trending ridges, and intervening tundra plains. The Northern Foothills have similar features, but they rise to only 600 to 1,200 feet. The flat topography of the Coastal Plain extends from the northern edge of the foothills to its limit beneath the Beaufort and Chukchi Seas. Several large rivers and numerous smaller streams flow northward across the Coastal Plain, and thousands of thaw lakes dot its surface. Drainage is poor as a consequence of the flat terrain and the occurrence of impermeable permafrost beneath a shallow, active freeze-thaw layer.

A system of lagoons and barrier islands lies beyond the Beaufort Sea and Chukchi Sea coastlines, extending approximately 2 to 20 miles offshore. The continental shelf of the Chukchi Sea is very shallow, with depths of less than 295 feet extending several hundred miles offshore. The Beaufort Sea, however, has a narrow shelf (with depths less than 600 feet) that extends 30 to 60 miles from the coast.

General Physiographic Aspects of the Bering Sea Subregion

The Bering Sea Subregion (fig. 5) possesses one of the largest continental margins in the world, and as such is a promising frontier area for the discovery of hydrocarbons. More than half the area occupied by the Bering Sea is underlain by a gentle, uniformly sloping continental shelf and a very steep continental slope. Compared to the average world shelf width of 39 miles, the Bering Shelf is of unusual size, ranging in width from 300 miles in the southeast to over 500 miles in the north (Sharma, 1979). The entire shelf is estimated to encompass more than 155,000 square miles, an area larger than the State of California. With the exception of several islands (including St. Lawrence, Nunivak, St. Matthew, and the Pribilof Islands), the shelf floor is essentially featureless and remarkably flat. The average gradient of the Bering shelf is reported to be just 1.3 feet per mile (Sharma, 1979).

The continental slope, which separates the shelf from the abyssal depths of the Aleutian Basin, is an 800-mile-long topographic feature that trends northwestward from the Alaska Peninsula to Siberia. Scarred by numerous canyons, this 10,560- to 11,220-foot slope can be divided into three physiographic provinces: southeastern, central, and northwestern. The southeastern province, extending from Unimak Island to the Pribilof Canyon, is characterized by a gradual shelf-slope transition; a smooth, gentle (1 to 2 percent) slope profile; and an outlying continental borderland (Unimak Plateau).

The central province of the Bering slope is approximately 450 miles long and extends from the Pribilof Canyon to the Prevenets Canyon. In contrast to the southeastern province, the topography of the central province is steep, rugged, and heavily scarred by canyons. The average slope within the region is 5 to 6 degrees, but it is not uncommon for some areas near subsea canyons to far exceed this average. Pribilof and Zhemchug are two exceptionally large subsea canyons within the central province of the Bering slope.

Little is known currently about the topographic character of the northwestern province of the Bering slope. Stretching from Prevenets Canyon to the vicinity of Cape Navarin, U.S.S.R., this province is thought to be neither as steep nor as rugged as the central province.

General Physiographic Aspects of the Gulf of Alaska Subregion

The Gulf of Alaska Subregion (fig. 6) is contained within two provinces: the Pacific-Margin Tertiary province and the Alaska Peninsula-Cook Inlet province. The northern Gulf of Alaska OCS is within the Gulf of Alaska Tertiary subprovince of the Pacific-Margin Tertiary province. The OCS part of the subprovince comprises approximately 20,000 square miles of offshore lands. The width of the continental shelf varies from 8 miles at the eastern end of the area to 65 miles in the west. The seafloor of the OCS is gently undulated, with six clearly defined submarine valleys separating extensive shelf areas. These valleys were formed during periods of continental glaciation when sea level was about 650 feet lower.

The Cook Inlet OCS includes 3,500 square miles of submerged land in the Cook Inlet petroleum subprovince of the Alaska Peninsula-Cook Inlet province. The water depth on the OCS in Cook Inlet is less than 660 feet. The inlet gradually deepens to the south, where it empties into the Gulf of Alaska and the Shelikof Strait.

The northern Gulf of Alaska is part of the nearly continuous seismically and volcanically active belt circumscribing the Pacific Ocean. During the last 75 years, five major earthquakes of magnitude 7.8 or

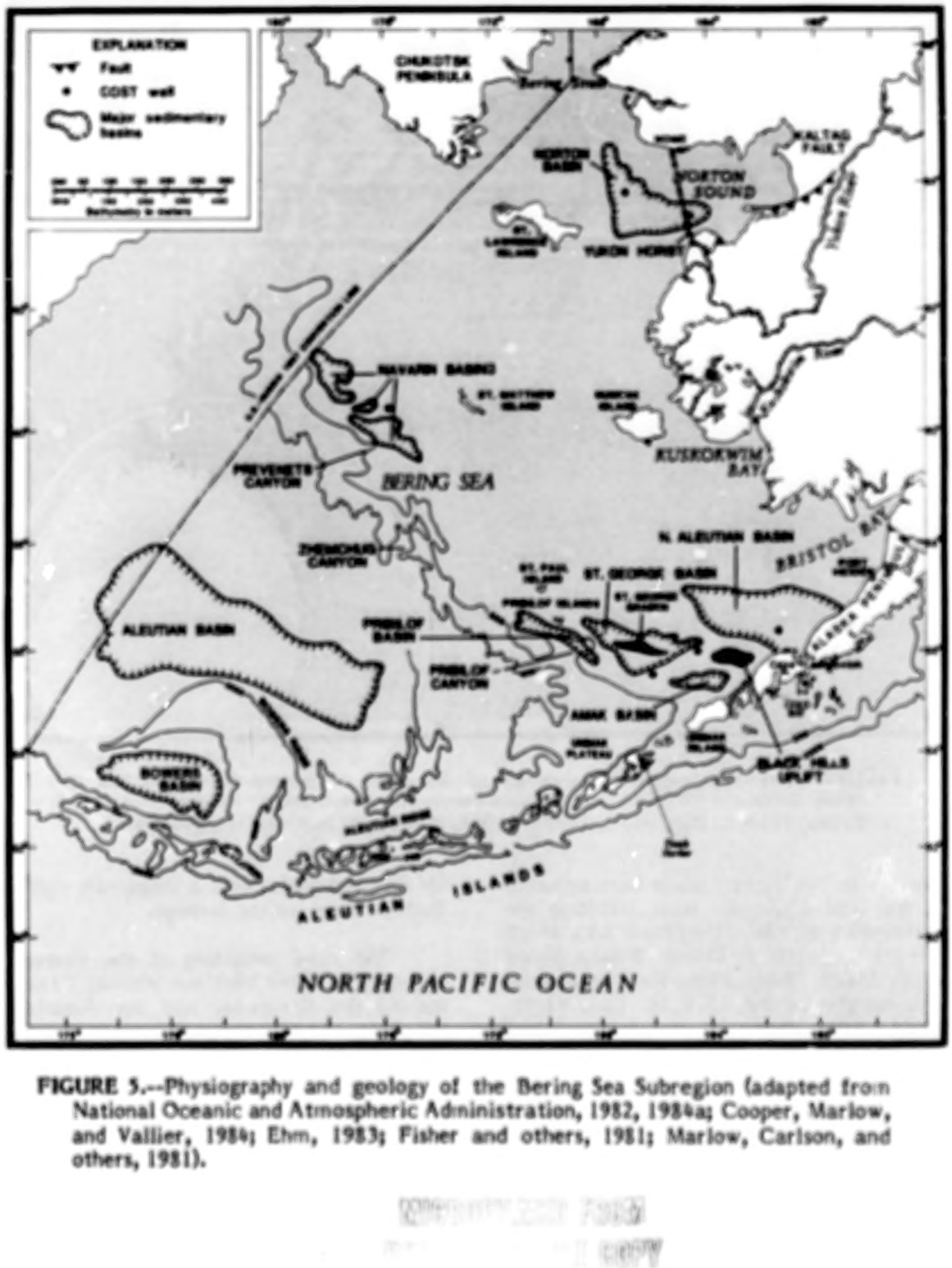

FIGURE 5.--Physiography and geology of the Bering Sea Subregion (adapted from National Oceanic and Atmospheric Administration, 1982, 1984a; Cooper, Marlow, and Vallier, 1984; Ehm, 1983; Fisher and others, 1981; Marlow, Carlson, and others, 1981).

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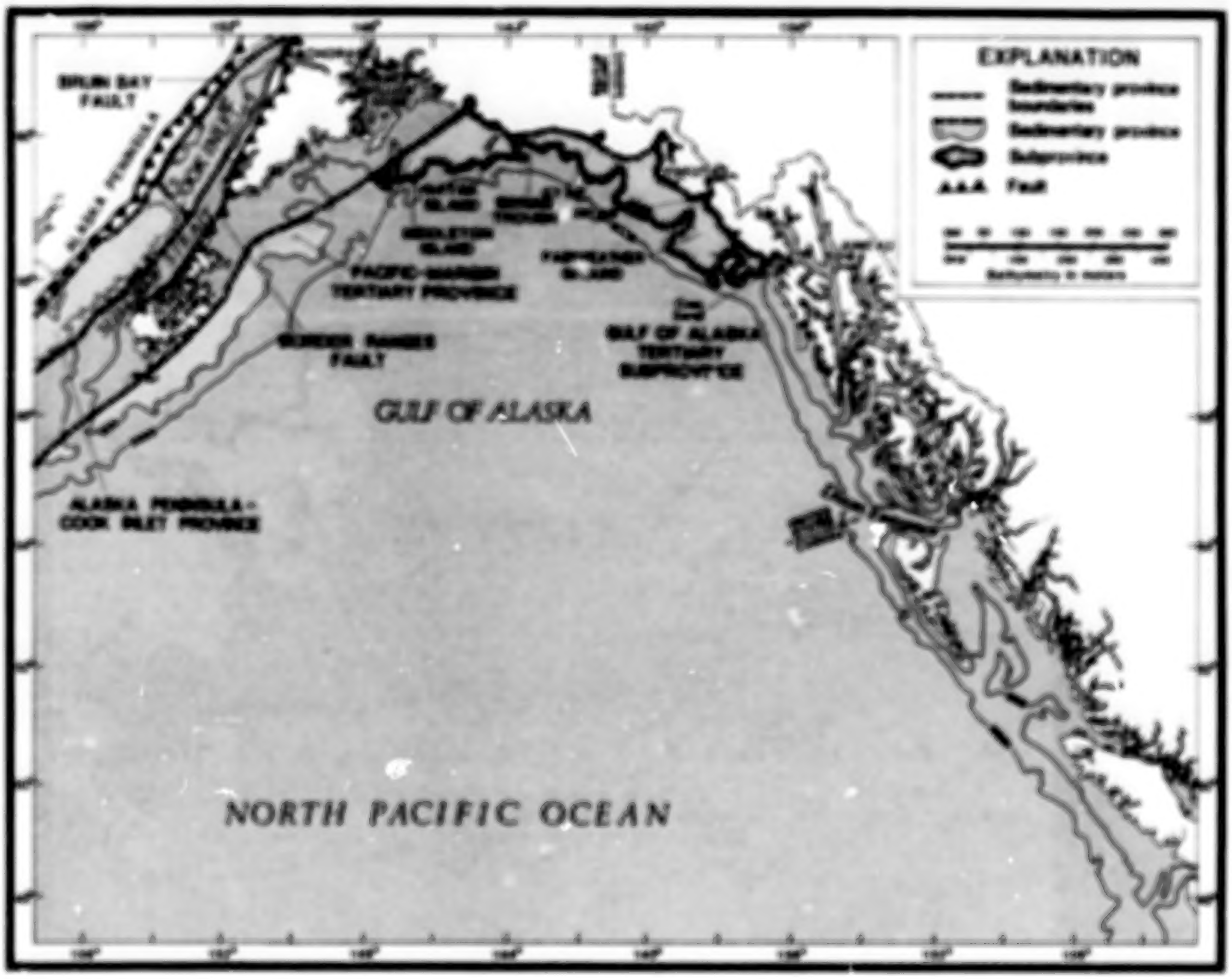

FIGURE 6.--Physiography and geology of the Gulf of Alaska Subregion (adapted from National Oceanic and Atmospheric Administration, 1984b; Ehm, 1983; Bruns, 1982; Grantz and Kirschner, 1976; Cooper, Scholl, and Marlow, 1976).

greater on the Richter scale have occurred in the Gulf of Alaska area, including the earthquake of 1964 (magnitude 8.4), which had its epicenter in Prince William Sound (DOI, 1980). Since then, the largest seismic event was the 1979 St. Elias earthquake with a magnitude of 7.7. This was a shallow, low-angle-thrust event located north of Icy Bay. The high seismic activity in this region has contributed to ongoing compressional deformation caused by the convergence of the North American and Pacific lithospheric plates. Based on geologic and seismic observations, the area between Prince William Sound and Icy Bay, informally known as the Yakataga Seismic Gap, has been identified as a probable site for an earthquake with a magnitude sufficient to cause severe damage.

The area consisting of the western boundary of Cook Inlet and Shelikof Strait, the Alaska Peninsula, and the Aleutian Island Arc is one of the most active volcanic regions in the world. Five active volcanoes are situated along the northwest margin of the inlet. With the exception of Mt. Douglas, all have erupted in recent historic time, and all are considered likely to erupt in the future. The most recent eruption was St. Augustine in 1976.

Within the Shelikof Strait, several active volcanoes are located in and around

Katmai National Park. In 1912, Katmai erupted and deposited nearly 1 foot of volcanic ash on Kodiak Island.

All the volcanoes located along the Alaska Peninsula are capable of violent eruptions because they are part of the active convergence zone between the North American and Pacific plates.

REGIONAL GEOLOGY AND PETROLEUM POTENTIAL OF THE ALASKA SUBREGIONS

Arctic Subregion

BEAUFORT SEA PLANNING AREA. The Beaufort shelf can be divided into two major provinces: (1) a landward area underlain by ancient continental crust called the Arctic platform and (2) an area near the shelf edge where thick clastic wedges of Cretaceous and Tertiary sediments were deposited upon Mesozoic oceanic crust. The highly faulted boundary between these provinces is termed the hinge line (see fig. 4, p. 7).

Acoustic and economic basement on the Arctic platform consists of a metamorphic complex (Franklinian sequence) that represents the roots of an Early Paleozoic belt of deformed rocks (fig. 7). Basement is overlain by Devonian through Jurassic strata (Ellesmerian sequence) deposited in a stable shelf setting. The Ellesmerian sequence thins and pinches out to the north toward the ancient landmass that once existed north of the modern Beaufort continental margin. Ellesmerian sedimentation terminated in Late Jurassic time with the thermal uplift of the Arctic platform prior to rifting in the vicinity of the present shelf edge. This uplift produced a regionally extensive Lower Cretaceous unconformity that led to an erosional truncation of Ellesmerian strata across the northern part of the Arctic platform.

All producing North Slope oil accumulations are in Ellesmerian sequence reservoir formations, and any part of the Arctic platform where these rocks are preserved is considered highly prospective. Known accumulations are trapped by a complex composite of sealing or capping surfaces including faults, structural dip, and truncation at regional unconformities, such as that associated with the major Lower Cretaceous erosional event. The northernmost parts of the Arctic platform are less prospective because of the absence of Ellesmerian formations, but they include grabens, which may contain suitable reservoir rocks deposited as part of the rift sequence. Excellent oil source beds are thought to be present at levels of thermal maturity adequate for oil generation and expulsion in all parts of the Beaufort continental shelf within the planning area.

Numerous structural and stratigraphic traps exist within the thick clastic wedge seaward of the hinge line. Any potential reservoir sands in this area were most likely deposited in a deltaic or prodelta setting, suggesting that individual accumulations may be small because of the reservoir's lenticular shape. Similar potential exists for analogous geological provinces, such as the Mackenzie Delta area of the Canadian Beaufort shelf. Rotational folds associated with listric faulting are the most attractive targets in the western area, while compressional folds and fault traps are the most prevalent trap configurations in the eastern area.

CHUKCHI SEA PLANNING AREA. Two geological provinces, the Chukchi Basin and the northern part of the Hope Basin, exist within the Chukchi Sea Planning Area. Each exhibits a distinct stratigraphic sequence and has contrasting but tectonically related structural elements. These two provinces are separated by a prominent structural feature, the Herald Arch.

The three stratigraphic sequences present in the Chukchi Basin--Franklinian, Ellesmerian, and Brookian--appear to be offshore extensions of western North Slope stratigraphy. These sequences represent stages in the tectonic development and

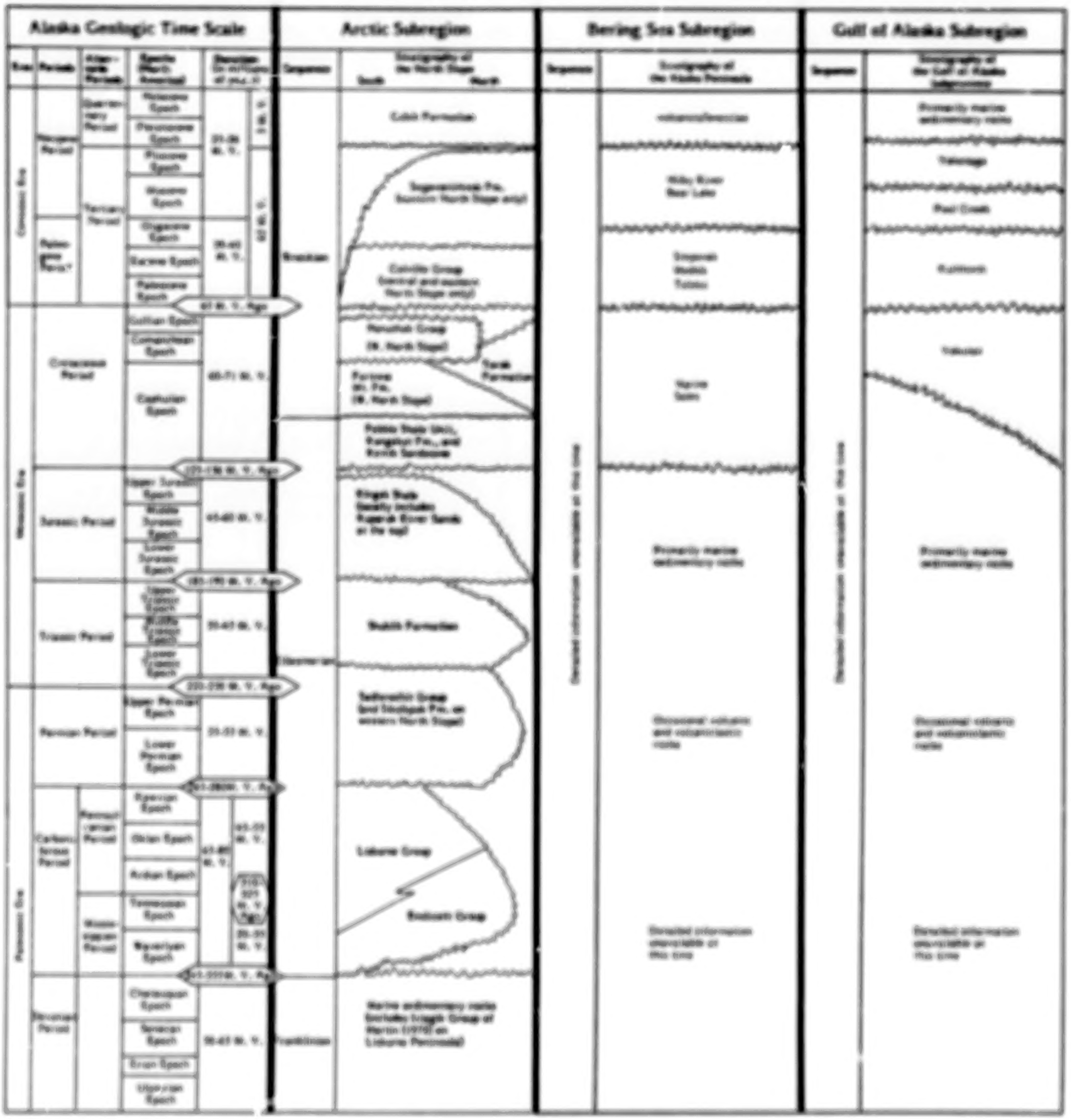

FIGURE 7.--Geologic time scale of the Alaska OCS Region (adapted from USGS, 1984; Jackson and Kurz, 1982; Bruns and Plafker, 1982; Grantz, Barnes, and others, 1980a; Marlow, McLean, and others, 1980).

depositional history of the basin. The Franklinian sequence encompasses Cambrian to Late Devonian rocks, which provided a stable platform for subsequent deposition and which constitute economic basement on the North Slope. The Ellesmerian sequence, Early Mississippian to Early Cretaceous in age, is composed of transgressive shallow-shelf marine carbonates, marine and nonmarine sandstone, and shale derived from a northerly source terrane. The Brookian sequence, Early Cretaceous to present age, is composed of deep-water to nonmarine, northwardly prograding deltaic sediments.

The best potential source rocks in the Chukchi Basin are the Shublik Formation, the Kingak shale, the Pebble shale of Ellesmerian age, and the Brookian Torok Formation, based on their high organic carbon content and high percentage of oil-prone kerogen. These rocks increase in thermal maturity and tendency for gas production to the south toward the Colville geosyncline.

The most prospective reservoirs in the planning area are the Lisburne Group, the Sadlerochit Group, the Shublik Formation, and the Sag River Formation, which are all oil productive at Prudhoe Bay. The best potential reservoir rock is the Sag River sandstone because of its high sand content and high porosity values.

The northern Hope Basin is an extension of the stratigraphy and structure of that part of the basin immediately to the south. The block-faulted basement, possibly Cretaceous in age, is believed to be overlain by nonmarine to marine Tertiary clastic rocks.

While both structural and stratigraphic traps are present in the planning area, structural traps predominate in the Barrow Arch and Chukchi platform regions. The areas with the highest hydrocarbon potential are the northeastern and western portions of the basin—the northern part of the Chukchi Basin, Barrow Arch, Arctic platform, and the Chukchi platform.

HOPE BASIN PLANNING AREA. Hope Basin is a Late Cretaceous to Tertiary sedimentary basin. The basement material throughout the area probably consists of Late Cretaceous or older rocks of the Brooks Range orogen.

Many structural, stratigraphic, and fault traps may exist in Hope Basin on the crest of or adjacent to the basement horst blocks. However, because of poor potential for source rocks in the pre-Tertiary basement and the generally thin, thermally immature Tertiary sedimentary section, the prospect for oil accumulation is low. Possible exceptions are traps adjacent to locally thicker sections, where the total combined sediment thickness may exceed 17,000 feet.

Two onshore stratigraphic test wells, the Nimiuk Point No. 1 and the Cape Espenberg No. 1 wells, were drilled north and south of the entrance to Kotzebue Sound just east of the planning area in 1974 and 1975 by Standard Oil of California. The Kotzebue Sound wells penetrated from 3,500 to 4,000 feet of Quaternary sediments and from 2,500 to 4,000 feet of Tertiary rocks that lie on Devonian or older metasedimentary basement. The rocks in these wells show excellent reservoir properties with an average sand content for the total section over 30 percent and average porosities over 25 percent. However, these favorable reservoir properties may be due to the proximity of the rocks to the source terrane and may not represent the type of rocks in the deeper offshore Hope Basin as the distal facies become finer grained.

Bering Sea Subregion

NORTON BASIN PLANNING AREA. Norton Basin consists of two subbasins filled with more than 14,000 feet of layered Tertiary sedimentary rocks. The basin formed as a result of pull-apart tectonics associated with Late Cretaceous or Early Tertiary strike-slip motion along the Kaltag fault. Apparently the two subbasins were not formed until the mid-Eocene when the north-trending Yukon horst developed as a common boundary. Continental sedimentation dominated Norton Basin prior to the mid-Eocene. Until the mid-Oligocene, the horst allowed a shallower marine siltstone and sandstone sequence to be deposited in the eastern subbasin, whereas deepwater clastics were deposited in the western subbasin. Post mid-Oligocene deposition extended beyond the controlled subbasins, indicating regional subsidence in response to crustal cooling. This extension unified subsequent deposition from late Oligocene to present within the two subbasins. This sequence of rock is mainly Oligocene coals and Neogene shallow-marine siltstones, sandstones, and diatomaceous mudstones.

Seismic-reflection surveying by government and academic institutions has been conducted since the mid-1960's. These surveys have been mostly uncoordinated reconnaissance mapping efforts investigating the regional geologic framework. Industry has been surveying Norton Sound since 1971 to establish a high-density seismic grid covering the prospective areas of the basin. A total of 49,500 trackline miles of deep-penetration, seismic-reflection data have been collected by industry to date.

ARCO Alaska, Inc., drilled a Continental Offshore Stratigraphic Test (COST) well in each Norton subbasin during the summers of 1980 and 1982. Table 1 lists COST wells drilled on the Alaska OCS. The COST well data indicated the most common organic material present is Type III humic kerogen. Sufficient temperatures for oil maturity exist below 9,500 feet in the western subbasin and below 10,600 feet in the eastern subbasin. Dry gas and wet gas condensate are most likely. Below 13,000 feet there is insufficient organic carbon to serve as a commercial hydrocarbon source. Sandstone porosities greater than 13 percent and permeabilities of 1 millidarcy are restricted to depths of less than 9,000 feet (mid-Oligocene or younger) in the eastern subbasin. Sandstone porosities greater than 24 percent and permeabilities of 1 millidarcy are restricted to depths of less than 6,000 feet (late Oligocene or younger) in the western subbasin.

Anticlines, faulted anticlines, fault traps, and stratigraphic pinchouts are present in the Norton Basin. Faults and unconformities provide migration routes. The major question facing Norton Basin hydrocarbon production is whether sufficient kerogen exists in source rocks. There are no known oil and gas fields within Norton Basin or similar Tertiary basins in the Bering Sea continental shelf.

NAVARIN BASIN PLANNING AREA. The Navarin Basin consists of three subbasins filled with more than 26,000 feet of layered Tertiary sedimentary rock. The subbasins formed as a result of extensional deformation associated with strike-slip motion or oblique subduction of the Kula plate beneath the North American plate in the Late Cretaceous to Early Tertiary time. Basin axes trend northwestward and parallel the continental shelf break. By the late Eocene, movement of the Kula plate was isolated by subduction at the Aleutian Arc. Subbasin subsidence in response to structural downdropping remained active until the late Oligocene. This subsidence allowed the continuous deposition of marine mudstones and siltstones throughout most of the Paleogene. Sea-level lowerings in the middle and late Oligocene, however, exposed older Tertiary and Mesozoic basement highs to wave-based erosion, which resulted in the deposition of coarser grained material along the subbasins' flanks. Cessation of Kula plate subduction by the late Eocene was followed by crustal cooling, which allowed regional subsidence beyond structurally defined subbasins. Middle and outer neritic mudstones and sandy mudstones were deposited throughout the Neogene, with a possibility of coarser grained deposits flanking basement highs that were exposed to wave-based erosion during a sea-level lowering in the late Miocene.

TABLE 1.—COST wells drilled on the Alaska OCS

Planning area and well number	Lease/ block no.	Operator	Spud date	Total depth (ft)	Date total depth reached	Report number[1]
Arctic Subregion						
None						
Bering Sea Subregion						
Norton Sound COST 1	OCS 80-7, Block 197	ARCO	06/14/80	14,683	09/16/80	OFR 83-124
Norton Sound COST 2	OCS 82-16, Block 373	ARCO	06/07/82	14,889	08/27/82	OFR 83-557
Navarin Basin COST 1	OCS 82-17, Block 801	ARCO	05/26/83	16,400	10/03/83	MMS 84-0031
St. George Basin COST 1	OCS 76-11, Block 439	ARCO	07/02/76	13,771	09/22/76	MMS 84-0016
St. George Basin COST 2	OCS 82-19, Block 390	ARCO	05/19/82	14,626	08/22/82	MMS 84-0018
N. Aleutian Basin COST 1	OCS 82-18, Block 646	ARCO	09/08/82	17,155	01/16/83	*
Gulf of Alaska Subregion						
Cook Inlet COST 1	OCS 77-5, Block 489	ARCO	06/10/77	12,387	09/26/77	OFR 78-145
Kodiak Shelf KSST 1	OCS 76-35, Block 573	ESCI	07/13/76	6,225	08/01/76	*
Kodiak Shelf KSST 2	OCS 76-35, Block 986	ESCI	08/04/76	6,557	08/23/76	*
Kodiak Shelf KSST 4	OCS 76-35, Block 781	ESCI	08/28/76	1,591	09/19/76	*
Kodiak Shelf KSSD 1	OCS 77-1, Block 999	Sun	05/25/77	8,514	07/17/77	*
Kodiak Shelf KSSD 2	OCS 77-1, Block 463	Sun	07/22/77	10,452	09/08/77	*
Kodiak Shelf KSSD 3	OCS 77-1, Block 16	Sun	09/13/77	9,355	10/25/77	*
Northern Gulf of Alaska - COST 1	OCS 76-65, Block 196	ARCO	07/22/75	5,100	10/09/75	*

[1] Open-file reports (OFR) are available at cost from the Open-File Services Section, Branch of Distribution, U.S. Geological Survey, Box 25425, Federal Center, Denver, CO 80225, or from the National Geophysical and Solar-Terrestrial Data Center, National Oceanic and Atmospheric Administration, Code D621, 325 Broadway, Boulder, CO 80303. MMS reports are available at cost from the Alaska OCS Regional Office, P.O. Box 101159, Anchorage, AK 99510.

*Not available at this time.

Industry-related seismic surveying has been conducted since 1971. A total of 90,653 trackline miles of deep-penetration, seismic-reflection data have been collected to date. ARCO Alaska, Inc., drilled a COST well in the summer of 1983. The well, part of the prelease investigative effort for Lease Sale 83, was drilled to a depth of 16,400 feet in the northern flank of the Navarin Basin about 110 miles west of St. Matthew Island.

COST well data indicate the late Eocene and early Oligocene mudstones to be the most favorable source rocks in the Navarin Basin. This stratigraphic sequence thickens in the deeper parts of the subbasins, possibly providing significant amounts of oil-prone rocks at a favorable level of thermal maturity. Possible reservoir rocks are Oligocene sandy mudstones, basal sands deposited by the early Tertiary transgression over the Mesozoic basement rocks, and coarse-grained deposits flanking basement highs that were deposited during sea-level lowerings in the Oligocene and Miocene. Traps found in the basin include anticlines, faulted anticlines, fault traps, and stratigraphic pinchouts. Many traps are adjacent to the potential source rocks; however, traps that are not adjacent may be fed by hydrocarbon migration along unconformities and faults and through permeable strata.

Hydrocarbon accumulations have not yet been reported in the Navarin Basin or other Tertiary basins in the Bering Sea. If accumulations are present in sufficient quantity, the major requirement enabling hydrocarbon production to occur in the Navarin Basin will be finding significant amounts of reservoir rocks having the appropriate permeabilities.

ST. MATTHEW HALL PLANNING AREA. The St. Matthew and Hall Basins formed as a crustal sag in the mid-continental shelf of the Bering Sea. The sag probably resulted from the regional downwarping associated with Late Cretaceous or early Tertiary strike-slip motion of the Kaltag fault (see fig. 5, p. 9). The west-trending Hall Basin is filled with less than 6,000 feet of layered Tertiary fill. The fill probably is late Oligocene and Neogene, marine, fine-grained sediments overlain by a relatively thin veneer of coarser grained Quaternary sediments. There are a few basement-controlled, faulted, anticlinal structures that occur within 3,000 feet of the surface.

The poor petroleum geologic characteristics of the basins prompted few industry-conducted geophysical surveys in the 1970's. A total of only 4,800 trackline miles of deep-penetration, seismic-reflection data have been collected by industry to date. No wells have been drilled in the planning area; however, there have been COST wells drilled in adjacent Tertiary basins in the Bering Sea.

Sediments adjacent to the St. Matthew and Hall Basins do not seem to contain significant potential source rocks at depths less than 6,000 feet or in rocks younger than the Eocene. Moreover, about 10,000 feet of sediments are usually necessary to raise the level of maturity in these basins to the generally accepted threshold of the "petroleum window." By implication, source rocks of at least Oligocene and preferably Eocene age would be necessary to guarantee adequate maturity for petroleum generation. The most likely source of petroleum, even in Cenozoic sediments, seems to lie in the pre-Cenozoic rocks for which there is little available data. If hydrocarbons are discovered in the St. Matthew or Hall Basins, they are most likely to be dry gas deposits. Potential reservoirs are more probable in Cenozoic rocks, but hydrocarbons are more likely to have been generated in the Cretaceous sediments, if they occur at all.

ALEUTIAN BASIN, BOWERS BASIN, AND ALEUTIAN ARC PLANNING AREAS. The Aleutian Basin, Bowers Basin, and Aleutian Arc Planning Areas encompass the various basins and ridges of the Bering Sea west of the Bering shelf edge. Several of the physiographically and geologically defined basins in the region span more than one of these planning areas. Because geologically rather than geographically defined provinces provide a more suitable framework for a discussion of the region's petroleum geology, the three planning areas have been combined into a single summary.

Thick sediment deposits with possible structural traps have been identified in these planning areas. However, the available data suggest that while the sediments in many of these locations are thermally mature, insufficient organic material is available in the sediments to generate enough hydrocarbons to permit migration into the traps. Migration and accumulation would also be impeded by the low permeabilities commonly associated with volcaniclastic sediments. Sediments on the Aleutian and Bowers Ridges, at the base of the Bowers Ridge, and beneath the Bering shelf rise and slope are thought to exhibit these characteristics.

Most of the Aleutian Basin, Bowers Basin, and Aleutian Arc Planning Areas have water depths too great to permit economically viable exploration efforts with currently available technology. Water depths shallow enough to be considered for exploration at this time include only the crestal areas of the Aleutian and Bowers Ridges in the Aleutian Arc and Bowers Basin Planning Areas and the upper rise and slope of the Bering shelf in the Aleutian Basin and Bowers Basin Planning Areas. However, the search for petroleum in these three planning areas has been limited to the collection and analysis of multichannel seismic-reflection data.

In addition to the seismic surveys, several Deep Sea Drilling Project (DSDP) holes have been drilled in those planning areas. These efforts are the result of a unique government-industry cooperative arrangement and represent the only drilling that has occurred in the planning areas to date. Although the DSDP locations were not selected for their petroleum potential, the stratigraphic information gathered has proven to be useful in a manner similar to COST well data in other areas. For example, heat flow measurements indicate that while the sediments are thermally mature, there is probably insufficient organic material in the sediments to generate a sufficient quantity of hydrocarbons.

ST. GEORGE BASIN PLANNING AREA. There are two major depocenters for Tertiary sediments on the continental shelf in this planning area: the St. George Graben and Pribilof Basin. Potential traps in the St. George Graben include faulted anticlines, upthrown fault traps over basement horst blocks, downthrown fault traps along border faults of the graben, drape of the Tertiary strata over basement fault blocks, stratigraphic onlap of Tertiary sediments onto the basement, and possible stratigraphic pinchout of sands. Outside the graben, potential traps include the sub-unconformity truncation below the Cenozoic-Mesozoic unconformity, anticlinal structures within the Mesozoic section, drape of the Tertiary strata over Mesozoic highs, fault-bounded traps, and stratigraphic onlap of Tertiary sediments onto Mesozoic highs. In the Pribilof Basin, potential traps include anticlines within the Mesozoic section with drape in the overlying Tertiary section, upthrown fault traps over tilted basement blocks, and sub-unconformity truncation associated with fault-bounded anticlines.

The best potential reservoir rocks are believed to occur in the Oligocene section. At COST well No. 1, Oligocene sands attained thicknesses greater than 150 feet. Porosities as high as 25 percent and permeabilities as high as 37 millidarcies were found. Volcanic rock fragments in the sands tend to reduce porosity and permeability because of diagenetic alteration to zeolites and clay minerals. The Mesozoic sandstones at COST well No. 2 were found to have low porosity and permeability.

Source rock potential, as indicated by the COST wells, appears to be low. Sediments were low in total organic carbon and were deposited under oxidizing conditions. Only gas-prone kerogen types were present in samples from the wells. Data indicate the Tertiary sediments to be immature for oil generation. The "petroleum window" occurs at approximately the base of the Tertiary section.

The deeper portions of the St. George Graben may have better source rock potential than the COST well sites because the basal graben sediments were deposited in an enclosed basin when the area south of the graben, where the COST wells were drilled, was emergent. Restricted circulation in the early development of the graben may have been conducive to organic preservation. Thermal maturity in the graben may also be more favorable than at the COST well locations. The basal graben sediments are buried more deeply than the lowermost Tertiary sediments at the COST well sites and, therefore, may have been exposed to high enough temperatures for a sufficiently long time to generate oil. The basal Tertiary section in the Pribilof Basin may also contain favorable source rocks.

NORTH ALEUTIAN BASIN PLANNING AREA. Three geologic trends lie within this planning area. The North Aleutian Basin proper lies north of latitude 55° 45' and is oriented approximately east-west. On its southern boundary is the Black Hills uplift, which trends westward from Cape Leontovitch. To the south of the uplift lies the Amak Basin. The large graben in the St. George Basin extends a few dozen miles into the west central portion of the planning area.

Sedimentary fill of the basin consists of up to 20,000 feet of Cenozoic sediments, thickest in the southeast part of the basin. Major Paleogene formations exposed onshore include, in order of decreasing depth, Tolstoi, Meshik, and Stepovak. The Tolstoi and Meshik Formations are largely volcanic conglomerate, sandstone, and breccia with some interbedded siltstones. The Stepovak has, in addition to volcanic sandstones and conglomerate, thick beds of black siltstone and lignite seams in the upper part of the sequence. All three formations are dense and highly indurated. In the Neogene, the Bear Lake and the Milky River are the two prominent formations. The former is porous sandstone and conglomerate with interbedded sandstone; the latter, lying above it, is conglomerate, sandstone, and mudstone. The Neogene formations and overlying Pleistocene volcanic flows and breccias were deposited in shallow-marine to nonmarine environments. Seismic data strongly suggest that these same formations continue offshore and dip to greater depths there.

Collection of geophysical data in the North Aleutian Basin began in 1963 and is complete enough to have allowed discovery and mapping of most significant structures in the basin.

Nine wells have been drilled on the Alaska Peninsula adjacent to the axis of Bristol Bay. Although a number of oil and gas shows were reported, none suggested a discovery of commercial size. One COST well has been drilled in southern Bristol Bay. Data from the onshore wells suggest that the most prospective area for hydrocarbons lies offshore between the Black Hills Uplift and the Amak Basin. More recent geophysical work shows that this area contains both the thickest Tertiary section and also the most promising anticlinal structures. Stratigraphic or fault traps may also exist along the south flank of the Black Hills uplift. In addition to those features, other less promising structures exist in the southwest corner of the basin and to the north of Port Heiden.

Data from two of the exploration wells drilled on the Alaska Peninsula suggest that the middle to late Miocene sandstones of the Bear Lake Formation have the greatest reservoir potential. At a subsurface depth of less than 6,300 feet, these sandstones have porosities as high as 36.5 percent and permeabilities as high as 1,286 millidarcies. Below 6,300 feet, the corresponding high values are 29 percent and 43 millidarcies. Shows of oil and gas have been reported from the Bear Lake sandstones in both wells and may possibly occur offshore.

The best Tertiary source rocks appear to be the black marine siltstone and shale beds in the Oligocene-age Stepovak Formation. Analysis of several wells onshore shows the Paleogene strata are rich in organic matter, but thermally immature. Offshore, however, these rocks should be more mature because they are located closer to the heat source emanating from below. Other potential source rocks include the basal units of the Bear Lake Formation and marine shales of Late Jurassic and Late Cretaceous age (if in angular discordance with overlying reservoir rocks).

Gulf of Alaska Subregion

SHUMAGIN PLANNING AREA. The tectonic setting of the Shumagin shelf is within an arc-trench gap that separates the active Alaskan Aleutian magmatic arc on the northwest from the Aleutian trench to the southeast. Since early Cenozoic time, the Pacific plate lithosphere has migrated northward relative to mainland Alaska and the North American Continent. This differential movement has been accommodated at the Aleutian trench where Pacific lithosphere is subducted beneath the Alaskan continental margin. The tectonostratigraphic evolution of the Shumagin forearc basins has been strongly controlled by the interaction of these two major crustal plates at this zone of convergence.

The Alaska Peninsula northwest of the Shumagin shelf contains a Mesozoic sequence of volcaniclastic sandstone and siltstone, in addition to a sequence of arkosic sandstone and conglomerates. Tertiary sedimentary rocks contain a high percentage of andesites with basaltic rock fragments.

Southeast of the shelf-type Mesozoic sequence of the Alaska Peninsula is the Shumagin Formation of Late Cretaceous age found on Sanak and the outer Shumagin Islands. The islands are an uplifted portion of the Shumagin shelf that exposes an ancient deepwater flysch sequence of interbedded sandstone and mudstone intruded by granitic plutons.

Geophysical data accumulated and tied into the adjacent geologic and geophysical interpretation of the Kodiak shelf indicate that two major tectonostratigraphic units underlie the Shumagin shelf. Acoustic basement consists of a highly deformed and disrupted sedimentary sequence ranging in age from pre-Paleocene to Oligocene. The basins rest upon acoustic basement and are filled with up to 25,000 feet of gently deformed shelf and upper slope sediments ranging in age from Miocene to Recent.

Folds and faults that deform the sequence of sediments on the shelf predominately follow the axis of the Aleutian trench. The rocks of the Kenai Peninsula, the Kodiak Islands, and the Shumagin Islands generally strike northeast, while rocks on the Sanak Islands strike northwest toward Unimak Island and the margin of the Bering Sea shelf beyond.

The Shumagin Planning Area is a frontier region without well data. The closest oil and gas fields are located within Cook Inlet, approximately 450 miles to the northeast. Since 1974, industry has gathered common depth point geophysical data across the planning area in a grid pattern. The results of these surveys, combined with geologic information from six COST wells and geophysical data on the adjacent Kodiak shelf, form the basis for understanding the resource potential of the area.

Preliminary observations of geophysical data indicate that both structural and stratigraphic traps located offshore appear capable of entrapping hydrocarbons. Verification of closure, in most cases, has been tentative, because of the low density of the geophysical data.

Because the sedimentary basins located beneath the Shumagin shelf contain over 25,000 feet of sediment, they may be of sufficient thickness for the generation and expulsion of hydrocarbons. Structures are considered most prospective where broad anticlinal folds and stratigraphic terminations flank basins within which adequate levels of thermal maturation have been reached. Dredge samples taken within the planning area indicate poor source rock potential. Geologic analysis of potential liquid hydrocarbon sources and potential reservoirs from the adjacent Kodiak shelf suggests a low to moderate probability of commercial accumulations within the Shumagin Planning Area.

KODIAK PLANNING AREA. The tectonic setting of the Kodiak shelf is also within the arc-trench gap that separates the active Alaskan Aleutian magmatic arc on the northwest from the Aleutian trench to the southeast. The tectonostratigraphic evolution of the Kodiak shelf forearc basin has been strongly influenced by the convergence of two major lithospheric plates.

The Kodiak shelf is underlain by two major tectonostratigraphic units. Acoustic basement beneath the shelf is composed of a highly deformed assemblage of flysch and mafic volcanic rocks ranging in age from pre-Paleocene to Oligocene. This basement complex is unconformably overlain by up to 25,000 feet of gently deformed shelf sediments ranging in age from Miocene to Recent. Available seismic data is only capable of resolving coherent, mappable reflectors within or at the base of the younger shelf sequence.

From 1975 through 1977, twelve seismic surveys collected a total of 25,388 trackline miles. After 1977, interest in the Kodiak shelf waned and only two additional seismic surveys were conducted. To date, industry has collected a total of 40,837 trackline miles of reconnaissance seismic data in this planning area. An additional 9,188 trackline miles of high-resolution seismic data have also been collected by industry-contracted vessels across the shelf. Six COST wells have been drilled—the first three were drilled in 1976 and the remaining wells were drilled the following year into Eocene strata.

Several DSDP holes have also been drilled seaward of the shelf break but within the planning area. The data generated by this drilling supplement information furnished by COST wells in the area.

Source rock potential underlying the Kodiak shelf is poor. Most strata contain less than 0.5 percent total organic carbon, rendering them marginal potential sources at best. Data from the Middleton Island exploration well, 125 miles along the strike to the northwest on the Alaska Peninsula, suggest that isolated source beds may be present in strata scattered throughout the Tertiary section that contain sufficient organic carbon to make them good potential source beds. Structured kerogen predominates in these source beds which, due to the low hydrogen/carbon ratio, indicates that these rocks would tend to generate gas rather than oil. Significant exceptions to this pattern are Eocene beds encountered below 9,000 feet that contain primarily amorphous kerogen. These beds, which have an aggregate thickness of 385 feet, could generate oil rather than gas. Thermal maturity of rocks sampled in the well is low, and rocks at the bottom of the well are only just approaching the early peak stage of oil generation and the early phase of gas generation. By analogy with the well, oil generation beneath the Kodiak shelf, if present, is in the early generation stage and thermogenic gas generation has not yet commenced.

Recognized hydrocarbon traps underlying the Kodiak shelf are simple structures limited to Neogene strata and are found throughout the Kodiak shelf. Trap types include simple folds, fault closures, and unconformity truncations. No regional seals are known to be present, but interbedded shales that enclose reservoir sands and that are capable of acting as local seals are presumed to be present in all structures.

Reservoir rocks are unlikely to be present in Paleogene strata because of both their original lithology and subsequent degree of alteration. However, some reservoir rocks with reservoir-quality porosity and permeability are inferred to be present in Neogene strata. Samples obtained from the Paleocene Ghost Rocks Formation and the Eocene and Oligocene Sitkalidak Formation have both low porosity and low permeability (1 to 3 percent and less than 0.1 millidarcy, respectively). Direct measurements of the porosity and permeability of Miocene and younger sandstones exposed onshore are not available, although thin Pliocene sands in the Middleton Island well range up to 18 percent in porosity. Lithologic descriptions of outcrops on Kodiak and surrounding islands reveal that, in general, sediment tends to increase in compositional maturity, porosity, and permeability with decreasing age throughout the sampled part of the Neogene.

The area underlying the Kodiak shelf is the geologic setting most favorable for hydrocarbon generation and entrapment. Because the logistical difficulties involved in drilling and production operations increase rapidly with water depth, it is the only part of the planning area considered to hold any promise of economical hydrocarbon production at this time.

GULF OF ALASKA PLANNING AREA. The stratigraphy of the Gulf of Alaska is dominated by four formations (see fig. 7, p. 12). The Mesozoic Yakutat Formation is believed to be the top of economic and acoustic basement in the Fairweather Grounds from Cross Sound to Dixon Entrance. Northeast of Cross Sound, the Yakutat Formation has a thick covering of Tertiary sediments. Above this formation is the middle Tertiary Kulthieth Formation which occurs in two offshore wells. It has good reservoir and source rocks, but wells have only reached it on the eastern and western flanks of the Bering Trough of the central Gulf of Alaska. The late Eocene to early Miocene Poul Creek Formation above the Kulthieth represents a fair source rock. It is seen both onshore and in five offshore wells where it is a thick shale. The Pliocene to Pleistocene Yakataga Formation is predominantly glacially derived sediments that have immature source rocks and poor reservoir rocks. This is the dominant section found by the 10 unsuccessful exploration wells drilled in the Bering Trough.

Onshore oil and gas exploration began in 1902 from Kayak Island to Dry Bay. The Katalla field, near Kayak Island, was the only producing field, and it was abandoned in 1933. Total cumulative production was approximately 150,000 barrels of oil. It should be noted that the State of Alaska approved 10 permit applications for development wells in the Katalla field on July 1, 1985. Offshore exploration began in 1969 near Middleton Island and continued until 1982. Twelve exploration wells and one COST well were drilled with no discoveries of an oil or gas reservoir. Most of these wells were drilled into the Yakataga Formation which has poor reservoir rock and immature source rock with low total organic carbon content.

Katalla, the only producing field along the Gulf of Alaska, produced oil along a fault zone in the Poul Creek Formation. Offshore, these rocks are a massive shale and a potential source for petroleum, but not a reservoir. In the five offshore wells that encountered the Poul Creek Formation, all had immature source rocks, and the total organic carbon content averaged 0.5 percent. The Kulthieth Formation may be a good reservoir and possibly another source for petroleum, but this formation was only found in two of the offshore exploration wells. The source rocks are mature and have over 1 percent total organic carbon. These source rocks are more prone to have gas than oil. Most exploration wells have been drilled through the Yakataga Formation, which is a very poor source rock and a fair reservoir rock.

The potential traps mapped on the Yakataga and Kulthieth Formations exist along faults in large anticlines that are asymmetric, elongate, and doubly plunging. Nine of these traps have been drilled with no discoveries of oil or gas.

COOK INLET PLANNING AREA. Rocks of the lower Cook Inlet are part of a belt of Mesozoic and Cenozoic sedimentary rocks that underlie the upper Cook Inlet on the northeast and the Alaska Peninsula and the Shelikof Strait on the southwest. Locally along this belt, marine Mesozoic rocks may be more than 36,300 feet thick, and continental Cenozoic rocks are as much as 25,080 feet thick. Four major northeast-trending geologic features that flank Cook Inlet are the Alaska-Aleutian Range batholith and the Bruin Bay fault on the northwest side, and the Border Ranges fault and the terrane of undifferentiated Mesozoic and Cenozoic rocks on the southeast side.

Commercial oil and gas fields are located both onshore and in State waters in the upper Cook Inlet north of Kalgin Island. Three Federal lease sales, Sales CI, 60, and RS-2, have been held in the planning area. Nine unsuccessful exploration wells and one COST well have been drilled in the lower Cook Inlet part of the planning area. Two of these wells had significant oil shows, but both wells were tested as being noncommercial.

Generalized lithologic characteristics have been compiled from the nine exploration wells and the COST well drilled in the lower Cook Inlet. These characteristics were used in evaluating the four ages of rocks--Jurassic, Early Cretaceous, Late Cretaceous, and Tertiary--for their reservoir and source potentials.

The Jurassic rocks are partially penetrated in nearly all the wells to as much as 12,000 feet. This section is very sandy, but it has uniformly low porosity and permeability caused by cementation. These rocks have poor reservoir potential.

Early Cretaceous rocks are absent in some areas, but reach a thickness of 2,500 feet elsewhere in the planning area. Although this interval has numerous sands, the sands have low porosities and permeabilities. The reservoir potential for the Early Cretaceous is considered to be poor.

Rocks in the Late Cretaceous are both marine and nonmarine. The marine section has from 1,000 to 5,000 feet of siltstone. These rocks have very few sands, and the sands have low porosity. In contrast, the nonmarine rocks contain more sand and have marginal porosities, and one well to the north of Cook Inlet encountered noncommercial quantities of oil. The marine rocks have poor reservoir potential, while the nonmarine rocks have good reservoir potential. The nonmarine section has only been found in the west central part of Cook Inlet.

The Tertiary rocks range from Miocene to Paleocene in age. These rocks, absent in the extreme western part of the planning area, are as much as 15,000 feet thick at the northeastern boundary. Lithology is characterized by nonmarine siltstones, sandstones, and conglomerates with interbedded coal. While most of the Tertiary section penetrated by the exploratory wells showed poor reservoir potential, favorable Oligocene and Miocene reservoirs are probably present in the northernmost part of the planning area.

Although no offshore well data are available in the Shelikof Strait, the previously described stratigraphy is believed to be similar. The petroleum potential for the Cook Inlet portion of the proposed Sale 88 leasing area is considered low. Eight of the best prospects in the area have been drilled, with noncommercial oil shows present in only two. Most wells displayed a marked lack of good reservoir rock.

OIL AND GAS RESOURCE AND RESERVE ESTIMATES

The Minerals Management Service (MMS) estimates oil and gas resources on Federal offshore lands. These estimates are provided to Congress in a biennial report submitted by DOI pursuant to section 606(c), (d), and (e) of the OCS Lands Act Amendments (OCSLAA) of 1978. These official estimates are based on geologic and geophysical data collected by MMS staff geologists and on oil industry data gathered from exploration and development operations on offshore lands leased to the oil companies by the Federal Government. The oil companies also provide seismic data to MMS that are gathered under prelease permits granted for such activity.

The most recent appraisal of undiscovered economically recoverable oil and gas resources in the Alaska OCS Region was made in July 1984 (Cooke, 1985). These estimates were developed using a computer-based model called PRESTO, an acronym for Probabilistic Resource Estimates - Offshore. PRESTO is a mathematical model used by MMS for offshore resource assessment that provides a range of resource estimates with a corresponding estimate of the probability of occurrence, and also provides reproducible results. This model is described in detail in appendix C of this document.

Undiscovered economically recoverable oil and gas resources are defined as those concentrations of naturally occurring liquid or gaseous hydrocarbons in the Earth's crust that are estimated to exist outside known fields and that are economically extractable using existing technology, assuming current price/cost relationships and short-term technological development. These resources currently include oil, condensate, and natural gas. Table 2 shows undiscovered economically recoverable resource estimates for oil and gas in the Alaska OCS Region.

To reflect the relatively high degree of uncertainty involved in these estimates, quantities are expressed as a range of values corresponding to different probability levels. In frontier areas, such as the entire Alaska OCS, accurate resource estimates are difficult to determine because of the relative scarcity of geologic data.

Reserve estimates are based on actual discoveries drilled from existing leases. Economically recoverable reserves have not been officially estimated for the Alaska OCS Region because of the lack of announced commercial discoveries to date. Also, the current worldwide surplus of oil has resulted in decreased activity by the offshore industry. The only potentially commercial accumulation known to extend into Federal-managed disputed waters is the Seal Island field. The Seal Island discovery was announced by Shell in early 1984, and total recoverable reserves are currently estimated at 300 million barrels. However, because delineation drilling has not occurred on the OCS, official reserve statistics have not been calculated for this field. (Note: A confirmation well was drilled from Tract BF-25, a disputed Federal OCS lease, in 1984.)

SUMMARY

The Alaska OCS Region encompasses an enormous area and is diverse in both physiography and geology. Because of its size and complexity, the region is divided into 3 subregions within which are 15 planning areas. Only a small percentage of the Alaska OCS has actually been explored to date.

Exploration efforts have included seismic surveys that have been performed by both government and industry, as well as 14 COST wells and several DSDP holes drilled on the Alaska OCS.

In addition to severe climatic and logistical constraints, the current worldwide surplus of oil coupled with the high cost of field development on the Alaska OCS require that offshore discoveries be comparatively large to be profitable. The prospects for discovery of such commercially recoverable offshore petroleum deposits appear to be highest in the Arctic and Bering Sea Subregions. The current attitude toward the Gulf of Alaska Subregion remains cautious following recent disappointments.

TABLE 2.—Estimates of undiscovered economically recoverable oil and gas resources in the Alaska Region as of July 1984

(Oil in billion barrels (BBO); gas in trillion cubic feet (Tcf).)

Planning area	Conditional oil (BBO) 95% case	Conditional oil (BBO) 5% case	Conditional oil (BBO) Mean case	Conditional gas (Tcf) 95% case	Conditional gas (Tcf) 5% case	Conditional gas (Tcf) Mean case	MP_{HC}[1]	Risked mean oil (BBO)	Risked mean gas (Tcf)	Risked BOE (BBOE)[2]
Arctic Subregion										
Beaufort Sea[3]										
Leased and unleased	0.23	3.22	1.28	1.01	13.13	3.62	0.70	0.89	0	0.89
Unleased	0.21	1.66	0.63	0.52	6.39	2.98	0.69	0.43	0	0.43
Leased	0.03	2.38	0.60	0.22	8.95	3.18	0.64	0.39	0	0.39
Chukchi Sea[3]										
Leased and unleased	0.96	4.88	2.68	3.06	27.71	15.10	0.20	0.54	0	0.54
Unleased	0.96	4.88	2.68	3.06	27.71	15.10	0.20	0.54	0	0.54
Leased	0	0	0	0	0	0	0	0	0	0
Hope Basin										
Leased and unleased	0.13	0.40	0.17	0.33	4.12	1.81	0.02	*	0.04	0.01
Unleased	0.13	0.40	0.17	0.33	4.12	1.81	0.02	*	0.04	0.01
Leased	0	0	0	0	0	0	0	0	0	0
Bering Sea Subregion										
Norton Basin										
Leased and unleased	0.09	1.64	0.64	0.51	6.31	2.96	0.15	0.09	0.43	0.17
Unleased	0.03	1.02	0.28	0.31	4.26	1.55	0.12	0.03	0.18	0.07
Leased	0.06	1.16	0.47	0.42	3.62	1.81	0.13	0.06	0.24	0.11
Navarin Basin										
Leased and unleased	3.05	6.88	4.80	3.63	8.51	5.84	0.27	1.30	1.58	1.58
Unleased	1.81	5.09	3.28	2.36	6.73	4.26	0.27	0.89	1.15	1.09
Leased	0.82	2.30	1.51	0.89	2.26	1.59	0.27	0.41	0.43	0.48
St. Matthew Hall										
Leased and unleased	*	*	*	*	*	*	*	*	*	*
Unleased	*	*	*	*	*	*	*	*	*	*
Leased	0	0	0	0	0	0	0	0	0	0
Aleutian Basin										
Leased and unleased	*	*	*	*	*	*	*	*	*	*
Unleased	*	*	*	*	*	*	*	*	*	*
Leased	0	0	0	0	0	0	0	0	0	0
Bowers Basin										
Leased and unleased	*	*	*	*	*	*	*	*	*	*
Unleased	*	*	*	*	*	*	*	*	*	*
Leased	0	0	0	0	0	0	0	0	0	0
Aleutian Arc										
Leased and unleased	*	*	*	*	*	*	*	*	*	*
Unleased	*	*	*	*	*	*	*	*	*	*
Leased	0	0	0	0	0	0	0	0	0	0
St. George Basin										
Leased and unleased	0.82	2.36	1.69	7.33	28.18	13.76	0.22	0.37	3.67	0.99
Unleased	0.37	1.98	1.12	3.42	18.04	9.24	0.22	0.23	2.03	0.61
Leased	0.24	0.91	0.37	2.40	12.04	6.60	0.22	0.13	1.63	0.38
North Aleutian Basin										
Leased and unleased	0.08	0.76	0.36	0.36	3.23	2.62	0.20	0.08	0.54	0.17
Unleased	0.08	0.76	0.36	0.36	3.23	2.62	0.20	0.08	0.54	0.17
Leased	0	0	0	0	0	0	0	0	0	0

TABLE 2.—Estimates of undiscovered economically recoverable oil and gas resources in the Alaska Region as of July 1984—Continued

(Oil in billion barrels (BBO); gas in trillion cubic feet (Tcf).)

Planning area	Conditional oil (BBO) 95% case	Conditional oil (BBO) 5% case	Conditional oil (BBO) Mean case	Conditional gas (Tcf) 95% case	Conditional gas (Tcf) 5% case	Conditional gas (Tcf) Mean case	MP_{HC}[1]	Risked mean oil (BBO)	Risked mean gas (Tcf)	Risked BOE (BBOE)[2]
Gulf of Alaska Subregion										
Shumagin										
Leased and unleased	0.03	0.09	0.03	0.49	2.63	1.42	0.03	*	0.04	0.01
Unleased	0.03	0.09	0.03	0.49	2.63	1.42	0.03	*	0.04	0.01
Leased	0	0	0	0	0	0	0	0	0	0
Kodiak										
Leased and unleased	0.04	0.26	0.13	0.38	7.13	2.92	0.03	0.01	0.13	0.03
Unleased	0.04	0.26	0.13	0.38	7.13	2.92	0.03	0.01	0.13	0.03
Leased	0	0	0	0	0	0	0	0	0	0
Gulf of Alaska										
Leased and unleased	0.16	1.00	0.56	1.80	18.46	8.36	0.08	0.06	0.66	0.16
Unleased	0.12	0.86	0.49	1.60	18.26	8.00	0.08	0.06	0.64	0.15
Leased	0.03	0.26	0.10	0.12	0.88	0.40	0.03	0.01	0.02	0.01
Cook Inlet										
Leased and unleased	0.06	0.46	0.21	0.08	0.76	0.33	0.03	0.01	0.01	0.01
Unleased	0.03	0.40	0.18	0.04	0.69	0.32	0.03	0.01	0.01	0.01
Leased	0.04	0.12	0.06	0.04	0.13	0.09	0.01	*	*	*
Total Alaska Region										
Leased and unleased								3.33	6.90	

[1] The marginal probability of hydrocarbons. The probability that economically recoverable hydrocarbons exist in the area under study.

[2] Risked barrels of oil equivalent (BOE) in billions of BOE.

[3] In the Chukchi Sea and Beaufort Sea OCS Planning Areas, water depth of 60 meters is considered to be the limit of current arctic production and development technology. Based on current cost/price relationships and foreseeable technological advances, the conditional mean gas resources estimated to exist in the Beaufort Sea and Chukchi Sea Planning Areas are assumed to be noneconomic at this time.

*Negligible.

NOTE: Three categories of resources (unleased, leased, and total) required three separate PRESTO computer runs for each planning area (see app. C). In some cases, splitting of prospects into leased and unleased caused portions of the prospects to be subeconomic. Therefore, the risked mean quantities for the unleased acreage arithmetically added to the risked mean quantities for the leased acreage may not result in the risked mean quantities for the total acreage. However, the total estimate was properly derived by running the PRESTO program for all prospects.

SOURCE: Cooke, 1985.

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2. Magnitude and Timing of OCS Development

Twelve Federal OCS lease sales for oil and gas exploration rights off Alaska have been held since the first sale in the region in 1976. These OCS sales, conducted in six Alaska Region planning areas, have resulted in more than 48.5 million acres being offered for lease, with leases for just over 4.9 million acres being awarded to offshore industry operators. Eight additional Federal OCS lease sales are planned for the Alaska Region under the current DOI 5-year lease sale schedule. Three of these sales are scheduled in planning areas where there have been no previous offerings of leases for development.

To date, on the more than 4.9 million OCS acres leased off Alaska, 61 exploratory wells have been spudded. As industry experience in harsh arctic or subarctic marine environments has grown since 1976 and public concern over the perceived risks has lessened, the pace of Alaska OCS exploratory work has increased. In addition to the exploratory wells, industry drilled 14 COST wells between 1975 and 1983 in the Alaska OCS Region to gather stratigraphic data. Table 3 presents an Alaska OCS Region lease sale history; figure 8 presents cumulative totals for exploratory wells spudded between 1976 and 1984. See table 1, p. 15, for a summary of data on COST wells drilled in the Alaska OCS Region.

This chapter is divided into four major sections: (1) review of the scheduling process for all Federal OCS lease sales as well as opportunities for public comment in the course of that process; (2) information on upcoming offshore lease sales in the Alaska OCS Region; (3) a summary of results of exploratory drilling in Federal waters off Alaska; and (4) a brief summary of oil and gas development activities in Alaska State waters.

DEVELOPMENT OF DOI'S NEW 5-YEAR OCS LEASING PROGRAM (1987-91)

As set out in the 1978 OCSLAA, DOI conducts all OCS lease sales, including those off Alaska, under a 5-year schedule prepared and revised regularly by the Secretary of the Interior, after notification of the President and Congress. In July 1984, DOI initiated the process of developing the third 5-year OCS oil and gas leasing program (49 FR 28332). The process of consultation and analysis required under the OCSLAA to complete a 5-year program is expected to take approximately 2 years. The importance of this 5-year program derives from the significant effect that the timing of lease sales has on the development of OCS hydrocarbon resources.

On March 21, 1985, the Secretary of the Interior, Donald P. Hodel, released for public comment the Draft Proposed Program (50 FR 11585-11593). On February 6, 1986, DOI issued the second of three planned drafts that will be prepared prior to approval of the final schedule--the Proposed Program (51 FR 4816-4821). The proposed program documents DOI's plans for meeting national energy needs and the balancing requirements of the OCSLAA in the future, based on past experiences with the OCS leasing program, present areas of concern, and projections of potential benefits and costs of hydrocarbon development.

Significant aspects of the proposed program, to cover the period from January 1987 to December 1991, include the following changes in DOI's existing offshore oil and gas leasing procedures:

- slowing the pace of leasing for most planning areas outside the Central and Western Gulf of

TABLE 3.—Lease sale history of the Alaska OCS Region as of December 31, 1985

Subregion	Planning area	Lease sale no.	Date held	Blocks offered	Acres offered	Blocks issued	Acres issued	Exploratory wells drilled	Existing leases
Arctic	Beaufort Sea	BF	12/11/79	46	173,423	26	83,776	7	26
		71	10/13/82	338	1,825,770	121	662,860	3	121
		87	08/22/84	1,419	7,773,447	227	1,207,714	2	227
		97	12/86*						
	Chukchi Sea	85	Canceled						
	Chukchi Sea	109	05/87*						
Bering Sea	Norton Basin	57	03/15/83	418	2,379,731	59	335,898	6	59
		100	03/86*						
	Navarin Basin	83	04/17/84	3,036	28,048,993	163	927,989	8	163
		107	09/86*						
	St. George Basin	70	04/12/83	479	2,488,787	96	940,917	10	96
		89	On hold						
		101	07/88*						
	North Aleutian Basin	31	Canceled						
		75	Canceled						
		92	01/86*						
Gulf of Alaska	Cook Inlet	CI	10/27/77	135	768,580	87	495,307	10	0
		60	09/29/81	153	838,267	13	73,137	3	6
		RS-2	08/[illegible]3/82	140	783,091	0	0	0	0
		88	On hold						
	Gulf of Alaska	39	04/13/76	189	1,008,900	76	409,038	11	0
		55	10/21/80	210	1,193,569	[illegible]	199,261	1	0
		RS-1	06/30/81	173	996,308	1	3,693	0	0
		88	On hold						
	Kodiak	46	Canceled						
		61	Canceled						
		99	Canceled						
	Shumagin	86	12/87*						
Total				[illegible]	[illegible]	[illegible]	[illegible]	61	698

*Sales planned under the July 1982 five-year schedule.

NOTE: Data in this table do not include 17 blocks bid upon in Lease Sale 83, nor 4 blocks bid upon in Lease Sale 87. These blocks are under jurisdictional disputes between the United States and the Soviet Union and between the United States and Canada, respectively.

SOURCES: MMS, 1985a; 1985b; 1985c.

Mexico from one sale every 2 years to one sale every 3 years;

- holding annual sales in the Central and Western Gulf of Mexico;
- holding an annual supplemental lease sale for selected drainage, development, and (or) rejected bid blocks outside the Central and Western Gulf of Mexico;
- allowing, through a flexibility provision, limited acceleration of the sale schedule from 3 years to 2 years in planning areas of higher value or higher interest so as to adapt to future unforeseen changes in the world energy market; and

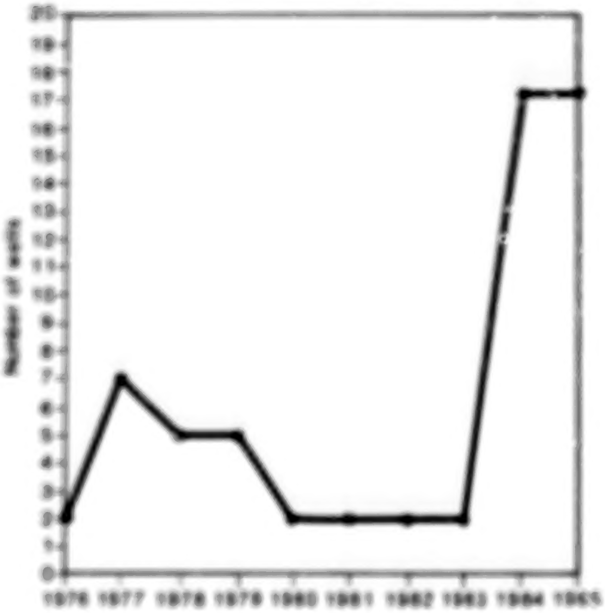

FIGURE 8.—Exploratory wells drilled in the Alaska OCS Region by year, 1976-85 (MMS, 1985e).

- adding an extra presale step, called a "request for interest," in 10 frontier exploration sales to occur 4 months before the call for information and nominations is issued in order to better assess industry interest in these areas (DOI, 1986).

Overall, the schedule proposes 27 standard sales, 10 frontier exploration sales, and 5 supplemental sales (fig. 9). In contrast, the current program, as approved in 1982, called for 40 standard sales and 1 reoffering sale. Ten of the sales in the proposed program are carried over from the 1982 five-year program. The new schedule proposes the first sale ever in the Hope Basin Planning Area of the Alaska OCS and the first offshore sale in 27 years for lands off Washington and Oregon in the Pacific OCS Region. The schedule proposes the following Alaska OCS lease sales as frontier exploration sales:

- Gulf of Alaska (1988),
- Kodiak (1991),
- Shumagin (1991),
- Hope Basin (1991), and
- Cook Inlet (1991).

The Secretary also stated his desire to focus lease sales on the most promising acreage in each planning area, deleting areas of low industry interest and (or) marginal resource potential as early in the sale preparation process as possible. To better focus on areas of resource potential most likely to be available for leasing, Secretary Hodel eliminated 15 portions, or subareas, of OCS planning areas from consideration. These include nine in the Pacific OCS Region, three in the Gulf of Mexico OCS Region, and three in the Atlantic OCS Region.

The Secretary also announced that 13 additional subareas would be highlighted for further analysis and public comment regarding their deletion from the leasing program. Three of these subareas are located in the Alaska OCS Region, including two adjacent to Unimak Pass in the St. George Basin and North Aleutian Basin Planning Areas (a total of about 210 blocks), and one of approximately 59 blocks offshore Point Barrow, Alaska.

To concentrate management resources on areas with higher resource potential and industry interest, no sales have been scheduled in the Alaska OCS planning areas of St. Matthew Hall, Aleutian Arc, Aleutian Basin, and Bowers Basin. In addition, no sale is scheduled for the Straits of Florida Planning Area in the Atlantic OCS Region because assessments of this area are incomplete.

The proposed leasing program incorporates careful consideration of the various factors involved in the effective management of the Nation's OCS resources: the equitable sharing of developmental benefits and environmental risks among the various regions; the existing geographical, geological, and ecological characteristics of each region; the needs of regional and national energy markets; the existing or anticipated use of the sea or seabed;

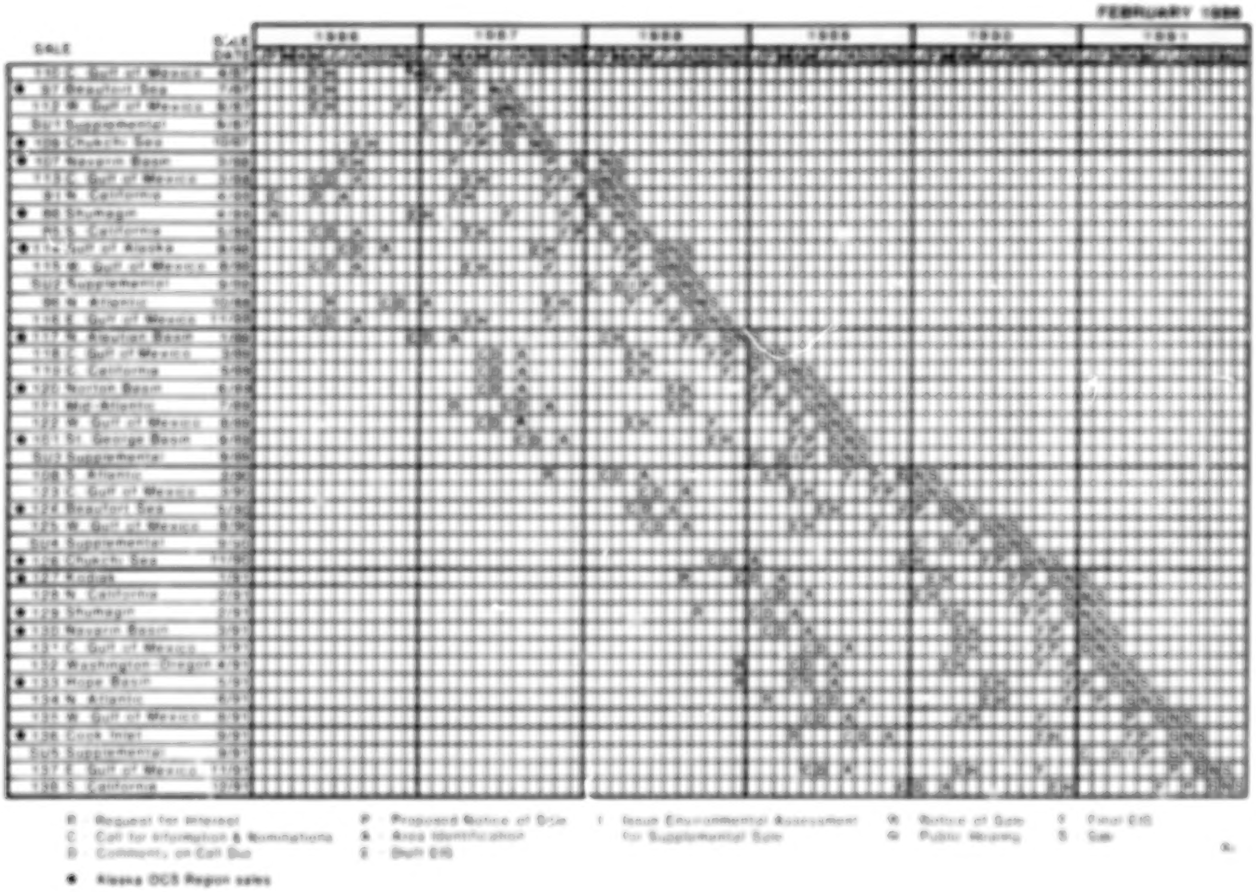

FIGURE 9.--Tentative milestones for the proposed 5-year offshore oil and gas leasing program, 1987 through 1991 (DOI, 1985b).

industry interest; affected States' laws, goals, and policies; the environmental sensitivity and marine productivity of the regions; and the receipt of fair market value for the rights conveyed.

As part of the program development process, DOI sought a relative ranking of the OCS planning areas both from industry's standpoint (table 4) and through MMS assessments of resources and the cost/benefit ratios of development in each region (table 5). These rankings give a national perspective on estimated offshore hydrocarbon resources.

Following a 90-day public review period of the proposed program, DOI will begin preparation of the proposed final program. The draft environmental impact statement (DEIS) was released on February 19, 1986 (51 FR 6043-6044), for public comment. Public hearings on the DEIS are tentatively scheduled for April 1986 in Boston, Massachusetts, Washington, D.C., Savannah, Georgia, Tallahassee, Florida, New Orleans, Louisiana, Los Angeles and San Francisco, California, Portland, Oregon, and Anchorage, Alaska. In early 1987, the final environmental impact statement (FEIS) and proposed final program are to be published. The Secretary's approval of the final 5-year program will follow appropriate consultation and a 60-day notification period before Congress and the President.

OCS ADVISORY BOARD

One of Secretary Hodel's first actions as the new Secretary of the Interior was to emphasize his commitment to thorough consultation with affected coastal States

TABLE 4.—Ranking of OCS planning areas based on industry interest in exploration and development

(Not all companies ranked all areas.)

Planning area	Range of industry rankings[1]
Central Gulf of Mexico	1 to 2
Western Gulf of Mexico	2 to 3
•Beaufort Sea	1 to 6
Southern California	1 to 8
Eastern Gulf of Mexico	3 to 10
•North Aleutian Basin	3 to 9
Central California	4 to 11
•Navarin Basin	4 to 10
Northern California	4 to 11
•Chukchi Sea	4 to 20
•St. George Basin	8 to 17
•Norton Basin	9 to 18
•Hope Basin	9 to 19
North Atlantic	12 to 17
Mid-Atlantic	11 to 21
•Cook Inlet	10 to 21
South Atlantic	12 to 22
Washington-Oregon	11 to 22
Straits of Florida	14 to 24
•Gulf of Alaska	13 to 22
•Shumagin	14 to 23
•Kodiak	18 to 23
•St. Matthew Hall	16 to 26
•Aleutian Basin	14 to 23
•Bowers Basin	21 to 26
•Aleutian Arc	20 to 26

•Alaska OCS Planning Areas

[1] Reflects highest to lowest ranking by companies ranking that area.

SOURCE: DOI, 1986.

TABLE 5.—Ranking of OCS planning areas based on MMS estimates of net benefits as of January 1987

Planning area	Net benefits[1] (millions of 1987 dollars) $19/bbl[2]	Net benefits[1] (millions of 1987 dollars) $29/bbl[2]
Central Gulf of Mexico	17,820	33,204
Western Gulf of Mexico	14,477	31,270
Southern California	3,938	9,068
South Atlantic	836	3,017
Central California	760	2,643
•Navarin Basin	114	2,364
Northern California	903	2,457
Eastern Gulf of Mexico	670	2,373
Mid-Atlantic	197	721
•Beaufort Sea	a	672
•Chukchi Sea	a	591
•St. George Basin	a	461
Washington-Oregon	207	433
North Atlantic	84	237
Straits of Florida	14	33
•Gulf of Alaska	a	33
•North Aleutian Basin	a	20
•Norton Basin	a	20
•Kodiak	b	b
•Hope Basin	b	b
•Shumagin	b	b
•Cook Inlet	b	b

•Alaska OCS Planning Areas

[1] Net benefits equal estimated net economic value of leasable resources minus estimated social costs of developing those resources.

[2] The $19- and $29-per-barrel starting oil prices reflect a range of weighted average prices of U.S. oil imports when the analysis began in 1984. These prices are then adjusted for real price growth and inflation to arrive at a January 1987 starting price of oil. Thereafter, prices are adjusted assuming a 1-percent annual real price growth.

[a] Resources estimated to be less than 0.5 million in 1987 dollars.

[b] Resources estimated to be negligible.

SOURCE: DOI, 1986.

on OCS activities, seeking to discuss all issues of concern and to reach mutually acceptable agreements wherever possible. These concerns echo the initiatives of the previous Secretary of the Interior, William Clark, to establish more harmonious relations between DOI, coastal States, industry, and special interest groups.

To aid the Secretary in achieving these goals, the OCS Advisory Board serves as a formal mechanism for DOI to receive views and recommendations from interested parties. The Advisory Board, a broad-based panel of experts on various aspects of the OCS leasing and development process, also provides a forum for discussion of related national and regional scientific, policy, and development issues.

The OCS Advisory Board is made up of three elements: the Policy Committee, the Scientific Committee, and six Regional Technical Working Groups (RTWG). Two of these three elements, the OCS Policy Committee and the six RTWGs, contribute directly to the 5-year OCS leasing program development process. The Scientific Committee, in guiding the MMS Environmental

Studies Program, indirectly contributes to the leasing program development process. Present membership of the national OCS Policy Committee is listed in table 6; membership of the Alaska RTWG, one of the six regional groups, is listed in table 7.

The OCS Policy Committee met on April 10-11, 1985, in Santa Monica, California, to review the draft proposed 5-year leasing program. The meeting was opened by Interior Secretary Hodel and included presentations by the Acting Assistant Secretary for Land and Minerals Management, the Director of MMS, and other officials involved with the new program's development. The committee members reviewed the draft proposal and appendixes in depth, heard explanations of the analysis processes and data used in formulating the document, and made recommendations for the next stages of the program's development.

The committee also passed resolutions supporting reauthorization of the Federal coastal zone management program and efforts to pass a program sharing OCS mineral revenues with coastal States.

The Policy Committee met most recently on November 6-7, 1985, in Mobile, Alabama. Although the proposed new 5-year program had yet to be released, the committee reviewed progress on the proposal's development and a number of other issues related to the OCS oil and gas

TABLE 6.—OCS Policy Committee membership as of December 31, 1985

Member	Affiliation
Department of the Interior	
William Betterberg	Director, MMS
Steve Griles	Assistant Secretary for Land and Minerals Management
Bill Horn	Assistant Secretary for Fish and Wildlife and Parks
Jack Rigg	Associate Director for Offshore, MMS
Michele Tetley (Executive Secretary)	Chief, Office of Offshore Information Services, MMS
State	
Ernest Mancini	Alabama
(vacant)	Alaska
Jananne Sharpless	California
Joseph Belanger	Connecticut
Robert Touhey	Delaware
Murice Rinkel	Florida
(vacant)	Georgia
Kent Keith	Hawaii
Charles Groat (Alternate)*	Louisiana
Charles Colgan	Maine
Kenneth Weaver	Maryland
James Hoyte	Massachusetts
Charles Deaton	Mississippi
David Scott	New Hampshire
Larry Schmidt	New Jersey
Greg Sovas (Alternate)*	New York
Stephen Conrad	North Carolina
Pat Amedeo	Oregon
Arthur Socolow (Alternate)*	Pennsylvania
Bruce Vild (Alternate)*	Rhode Island
Patricia Jerman	South Carolina
William Fisher	Texas
J. B. Jackson	Virginia
Donald Moos	Washington

TABLE 6.—OCS Policy Committee membership as of December 31, 1985—Continued

Member	Affiliation
Private Sector	
James Dunlop	Gas
Hal Scott	Environmental
Sarah Chasis	Environmental
Tom Rollins	Oil
O. J. Shirley	Oil
(vacant)	Local government
Jeffrey Robert Stephan	Fisheries
Carl Sullivan	Fisheries
August John Felando	Fisheries
Carroll Hill	Small business
Carl Savit	Offshore support industry
Ralph Cormany	Other
Ex-Officio (Federal)	
Fred Sterns	Department of Defense
David Beecy	Department of Energy
Allan Hirsch	Environmental Protection Agency
Peter Tweedt	Department of Commerce
Joseph Canny	Department of Transportation
(vacant)	Department of State
Rchard Smith (alternate)	Department of State
At Large (Federal)	
J. J. Simmons	Interstate Commerce Commission

*Lead representative from this State has not been appointed.

NOTE: For further information, contact the Committee Staff for the OCS Policy Committee, at (202) 343-9314.

leasing program. Among the topics covered were (1) pending congressional legislation concerning the OCSLAA; (2) efforts at improving the conflict resolution process with specific emphasis on the situation in California; (3) reports on activity in the Gulf of Mexico OCS Region; (4) a review of technology developments; (5) a presentation on the ocean incineration issue; and (6) an update on the work of the OCS Advisory Board's Scientific Committee. The Policy Committee is expected to meet next in Charlestown, South Carolina, during March 1986.

The Alaska OCS Region RTWG has met four times over the past 14 months to consider issues related to oil and gas development on the Alaska OCS. On December 5-6, 1984, the group met in Anchorage; the main agenda items included:

- a summary of the OCS Policy Committee meeting held on October 23-25, 1984;
- the status of Alaska OCS oil and gas lease sales and the current 5-year leasing program;
- coordination efforts for Sale 92, North Aleutian Basin;
- boundary issues;

TABLE 7.--Alaska Regional Technical Working Group membership

Member	Affiliation
Alan Powers	Regional Director, Alaska OCS Region Minerals Management Service
Gerald Reid	U.S. Fish and Wildlife Service
Byron Morris	National Marine Fisheries Service
Capt. T. Wood	U.S. Coast Guard
Alfred Ewing	Environmental Protection Agency
William Van Dyke	Alaska Department of Natural Resources, Division of Oil and Gas
Paul Gronholdt	Private citizen
Nancy Stehle	Office of Assistant Secretary of the Navy

For further information concerning the Alaska Regional Technical Working Group, contact Nancy Swanton, MMS Alaska OCS Region, P.O. Box 101159, Anchorage, AK 99510; telephone: (907) 261-4080.

- transportation plans for exploration and development of oil and gas resources in the Bering Sea;
- geophysical activities off Alaska;
- the Regional Studies Program and Information Transfer Meeting (ITM);
- alternate uses/disposal of gravel islands; and
- the Concrete Island Drilling System (CIDS).

On May 31, 1985, the RTWG met again at the conclusion of the annual ITM in Anchorage. At the RTWG meeting, the following topics were considered:

- a summary of the OCS Policy Committee meeting held on April 10-11, 1985;
- the status of Alaska OCS oil and gas lease sales and the current 5-year leasing program;
- the status of petroleum development activities in the Alaska OCS Region and additional activity planned through 1985;
- development of the new 5-year oil and gas leasing schedule for mid-1986 through mid-1991;
- future goals and activities of the Alaska RTWG;
- review of the proposed regional studies program for fiscal year 1987; and
- a presentation about the petroleum development timetables used by MMS.

On September 19, 1985, the RTWG met off Alaska's North Slope to tour and inspect CIDS, which was on location in the Beaufort Sea under contract to Exxon. More information on CIDS, an innovative, mobile Arctic offshore drilling unit, is presented later in this chapter, p. 42.

Most recently, the Alaska RTWG met in Anchorage on November 21, 1985. Topics considered at the gathering included:

- an update of activities in the Alaska OCS Region;

- drillship operations in the Beaufort Sea and technologies for drilling in deeper waters of the Arctic;
- oil-spill contingency planning and cleanup in the Arctic marine environment;
- bowhead whale monitoring programs and the response of whales to petroleum exploration in the Beaufort; and
- review of a film produced on CIDS.

The RTWG meetings are open to the public, and interested persons may make oral or written presentations to the group. The next meeting is tentatively scheduled for late spring 1986 and will be held in conjunction with the annual Alaska ITM sponsored by MMS. Further information on Alaska RTWG activities and copies of the minutes from meetings are available by contacting the following office:

RTWG Coordinator
Minerals Management Service
Alaska OCS Regional Office
P.O. Box 101159
949 E. 36th Avenue
Anchorage, AK 99510

FEDERAL OCS LEASING ACTIVITY IN ALASKA

Ten lease sales and two reoffering sales have been held in the Alaska OCS Region to date. In the course of these sale offerings, 8,738 blocks covering more than 48.5 million acres have been made available to offshore operators for lease (allowing for overlap of blocks offered in more than one sale). Of the blocks offered, 902 have been leased covering the development rights to just less than 5 million acres. Table 3, p. 28, presents a complete postlease sale history of the Alaska OCS Region. Figure 10 shows the relative holdings of OCS acreage in Alaskan waters among the major offshore operators in the region.

Table 8 summarizes prelease sale data for each of the Alaska OCS lease sales currently scheduled under the July 1982 five-year OCS leasing program. Information on forthcoming sales is based on the most recent milestone chart (fig. 11) and the "Regional Statistical Summary" published by MMS's Alaska OCS Regional Office. Much of the information is subject to revision in the process of developing a third 5-year OCS lease sale schedule. That schedule will be effective from January 1987 to December 1991, superseding the current 5-year schedule.

EXPLORATION ACTIVITIES ON THE ALASKA OCS

With the introduction of areawide leasing, advances in technology allowing for safe yet relatively less expensive exploratory drilling, and increasing experience and knowledge of many areas of the Alaska OCS, the pace of industry activity in the region has greatly increased. The years 1984 and 1985 brought the most significant gains in exploratory work (see fig. 8, p. 29).

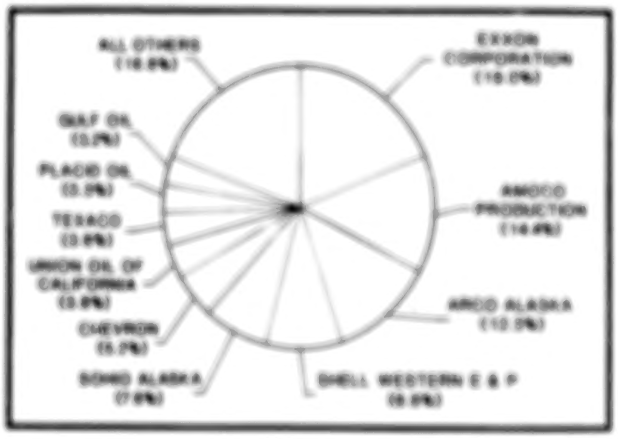

FIGURE 10.--Major Alaska OCS leaseholders with percentages of lands held (MMS, 1985e).

TABLE 8.—*Prelease sale milestones history, Alaska OCS Region, as of December 31, 1985*

Lease sale		Call for information/ Call for nominations and comments	Blocks available for nomination	Area identification/Tent. tract selection (public announcement)	Blocks identified for further study	DEIS (NOA)	FEIS (NOA)	Proposed notice of sale	Notice of sale	Blocks offered for lease	Sale
No.	Area										
39	Gulf of Alaska	02/06/68 33 FR 2612 11/27/74 39 FR 41387	2,176	03/20/73	330	06/26/75 40 FR 27061	11/18/75 40 FR 53413	-	03/12/76 41 FR 10792	189	04/13/76
CI	Cook Inlet	09/22/73 40 FR 43519	450	03/02/76	152	07/13/76 41 FR 28808	12/03/76 41 FR 53138	-	01/19/77 42 FR 3803 09/16/77 42 FR 46614 09/21/77 42 FR 47395 09/23/79 42 FR 48400	135	10/27/77
BF	Beaufort Sea	03/10/78 43 FR 9871	236	03/08/79 44 FR 12773	186	03/30/79 44 FR 19045	08/10/79 44 FR 47116	08/23/79 44 FR 49512	11/07/79 44 FR 64751	117	12/11/79
55	Gulf of Alaska	05/23/78 43 FR 22456 06/15/78 43 FR 25879	1,861	10/27/78	350	08/31/79 44 FR 51362	03/21/80 45 FR 18491	06/05/80 45 FR 37895	09/10/80 45 FR 59750	210	10/21/80
60	Cook Inlet	12/28/78 43 FR 60671	883	05/31/79	153	08/20/80 45 FR 55534	03/03/81 46 FR 15330	05/11/81 46 FR 26224	08/28/81 46 FR 43636	153	09/29/81
71	Beaufort Sea	10/31/79 44 FR 62606 11/29/79 44 FR 68525 01/17/80 45 FR 3391	2,466	04/09/80	372	12/23/81 46 FR 62324	05/25/82 47 FR 22615	06/16/82 47 FR 26081	09/13/82 47 FR 40362	338	10/13/82
57	Norton Basin	04/30/79 44 FR 25276 05/07/79 44 FR 26810*	4,709	02/20/80	429	06/24/81 46 FR 32673	02/23/82 47 FR 7881	11/04/82 47 FR 50162	02/04/83 48 FR 5315 02/10/83 48 FR 6186	418	03/15/83

TABLE 8.—Prelease sale milestones history, Alaska OCS Region, as of December 31, 1985—Continued

Lease sale No.	Lease sale Area	Call for information/ Call for nominations and comments	Blocks available for nomination	Area identification/Tent. tract selection (public announcement)	Blocks identified for further study	DEIS (NOA)	FEIS (NOA)	Proposed notice of sale	Notice of sale	Blocks offered for lease	Sale
70	St. George Basin	07/26/79 44 FR 43618	8,298	02/27/80	479	10/21/81 46 FR 51653	08/25/82 47 FR 37295	12/08/82 47 FR 55364	03/10/83 48 FR 10262	479	04/12/83
83	Navarin Basin	05/21/82 47 FR 22335	6,638	11/17/82	5,296	06/22/83 48 FR 28537	11/28/83 48 FR 53607	12/09/83 48 FR 55187 03/16/84 49 FR 10068**	03/16/84 49 FR 10058 04/11/84 49 FR 14452*	5,036	04/17/84
87	Beaufort Sea	11/23/82 47 FR 52782	9,004	03/16/83	3,333	09/21/83 48 FR 43105	03/16/84 49 FR 9963	03/19/84 49 FR 10189	07/23/84 49 FR 29723 07/31/84 49 FR 30601*	1,419	08/22/84
88	Gulf of Alaska/ Cook Inlet	03/16/83 48 FR 11224	24,961	06/16/83	4,792	01/20/84 49 FR 2550	07/13/84 49 FR 28630	08/07/84 49 FR 31638			On hold
89	St. George Basin	04/29/83 48 FR 19481	12,625	07/21/83	12,625	03/10/84 49 FR 19910	04/17/85 50 FR 15233	05/22/85 50 FR 21202			On hold
92	North Aleutian Basin	04/29/83 48 FR 19478	5,947	07/21/83 03/09/84*	990	01/17/85 50 FR 2629	09/06/85 50 FR 37061	09/10/85 50 FR 36974	12/16/85 50 FR 51372		Proposed January 1986
100	Norton Basin	03/05/84 49 FR 8084	5,619	06/26/84	1,755	03/15/85 50 FR 11016	10/04/85				Proposed March 1986
107	Navarin Basin	04/24/84 49 FR 17686	5,051	07/24/84	5,051						Proposed September 1986

TABLE 8.—Prelease sale milestones history, Alaska OCS Region, as of December 31, 1985—Continued

Lease sale		Call for information/ Call for nominations and comments	Blocks available for nomination	Area identification/Tent. tract selection (public announcement)	Blocks identified for further study	DEIS (NOA)	FEIS (NOA)	Proposed notice of sale	Notice of sale	Blocks offered for lease	Sale
No.	Area										
97	Beaufort Sea	09/24/84 49 FR 37532	9,004	01/22/85	3,930						Proposed July 1987
109	Chukchi Sea	01/28/85 50 FR 3870	5,448	05/31/85	5,448						Proposed October 1987
86	Shumagin	11/26/85 50 FR 48258	13,094								Proposed April 1988
114	Gulf of Alaska	(Request for Interest) 10/31/85 50 FR 45574	23,871								Proposed August 1988
101	St. George Basin										Proposed September 1989

*Correction/revision.
**Date change.
(NOA) = Notice of availability.
SOURCE: MMS, 1985a; DOI, 1986.

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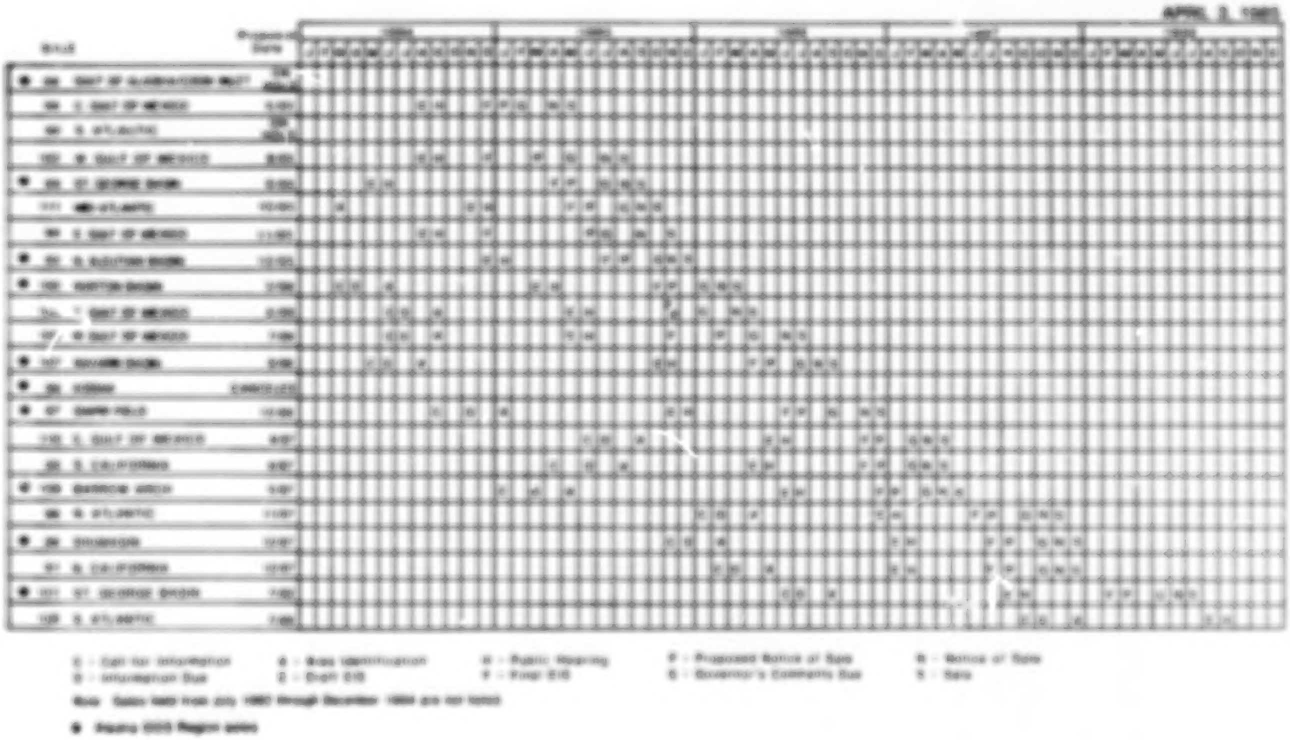

FIGURE 11.--Tentative milestones for the current 5-year oil and gas leasing schedule, April 3, 1985 (MMS, 1985b). (For information regarding the timing of events leading up to a lease sale, contact Steve Brooks, Public Affairs, MMS Alaska OCS Regional Office, at (907) 261-4070, or Michele Tetley, Chief, Office of Offshore Information Services, at (202) 343-9314.)

From September 1976, when the first exploratory well was drilled in the Alaska OCS, through December 1985 a total of 61 wells were drilled in the region; there were 12 wells in the Gulf of Alaska Planning Area, 13 in the Cook Inlet, 10 in the St. George Basin, 6 in the Norton Basin, 12 in the Beaufort Sea, and 8 in the Navarin Basin. From 1980 through 1983, a total of only 8 wells were drilled in the Alaska OCS. However, in 1984 there were 17, and in 1985 there were 16 wells drilled in the region with operations continuing on one well at year's end. A complete history of offshore drilling in the Alaska OCS is presented in table 9.

The following section focuses on drilling activity on the Alaska OCS from the second half of 1984 through December 1985. More information on earlier exploratory work in the region is available in the previous Arctic, Bering Sea, and Gulf of Alaska/Lower Cook Inlet Subregion Summary Reports. A complete list of OCSIP documents is provided on the inside front cover of this report.

Arctic Subregion Exploratory Activity

The Beaufort Sea Planning Area has been the scene of continuing innovative exploration projects through 1984 and 1985. The industry off Alaska has been showing an interest in employing technologies from the Canadian Arctic as operators move away from their early reliance on gravel island drilling platforms. Gravel islands, while very safe and secure, limit offshore exploratory work. They are relatively expensive and time consuming to construct, can only be used to explore one prospect, and are only practical to build in water depths of less than about 50 feet.

TABLE 9.—Alaska OCS Region drilling history through December 1985

Planning area	Sale	Prospect[1]	Block no./OPD	Lease no. (OCS-Y)	Operator	Drilling unit	Well	Spud date	Date plugged and abandoned
Gulf of Alaska	39	Maria	106 (NO 7-1)	0011	SWEPI	Sedco 706	1	09/01/76	01/28/77
	39	Salome	72 (NO 7-1)	0007	ARCO	Ocean Ranger	1	10/21/76	06/03/77
	39	Yvonne	111 (NO 7-1)	0014	SWEPI	Sedco 706	1	02/11/77	06/19/77
							2	06/20/77	09/12/77
	39	Setter	284 (NO 7-1)	0050	Exxon	Alaskan Star	1	03/08/77	07/08/77
	39	Cape Suckling	241 (NO 7-1)	0046	Texaco	Ocean Bounty	1	04/15/77	07/15/77
	39	Walrus	329 (NO 7-1)	0039	Gulf	Aleutian Key	1	05/13/77	08/16/77
	39	Raccoon	363 (NO 6-2)	0080	Exxon	Alaskan Star	1	07/09/77	01/04/78
	39	Marriot	414 (NO 7-1)	0072	Exxon	Alaskan Star	1	01/09/78	03/17/78
	39	Yakataga	162 (NO 7-1)	0032	Texaco	Ocean Bounty	1	07/17/77	02/25/78
	39	Grizzly	165 (NO 7-1)	0035	Exxon	Alaskan Star	1	03/23/78	07/01/78
	55	Yakutat	932 (NO 7-2)	0211	ARCO	Ocean Odyssey	1	04/10/83	10/22/83
Cook Inlet	CI	Guppy	318 (NO 5-2)	0086	Marathon	Diamond M Dragon	1	07/21/78	12/22/78
	CI	South Arch	468 (NO 5-2)	0124	Phillips	Ocean Bounty	1	10/09/78	10/19/78
							1A	10/20/78	03/18/79
	CI	Coho	2 (NO 5-4)	0168	Marathon	Diamond M Dragon	1	01/11/79	04/27/79
							2	04/29/79	08/22/79
	CI	Bede	798 (NO 5-2)	0136	Phillips	Ocean Bounty	1	03/28/79	09/18/79
	CI	Hawk	572 (NO 5-1)	0161	ARCO	Dan Prince	1	07/13/79	01/19/80
	CI	Bowhead	970 (NO 5-2)	0152	Phillips	Ocean Bounty	1	09/24/79	04/26/80
	CI	Raven	401 (NO 5-2)	0097	ARCO	Dan Prince	1	04/06/80	05/29/80
	CI	Ibis	576 (NO 5-2)	0113	ARCO	Ocean Bounty	1	05/08/80	06/24/80
	60	Falcon	225 (NO 5-2)	0243	Chevron	Sedco 712	1	09/19/84	11/12/84
	60	Cardinal	634 (NO 5-3)	0248	Chevron	Sedco 712	1	11/21/84	12/18/84
							1A	12/18/84	03/13/85
St. George Basin	70	Tustemena	809 (NO 3-7)	0530	Exxon	Doo Sung	1	06/29/84	09/04/84
	70	Tustemena	764 (NO 3-7)	0527	Exxon	Doo Sung	1	09/13/84	11/19/84
	70	Intrepid	714 (NO 3-7)	0519	Chevron	Sedco 712	1	07/20/84	09/23/84
	70	Rat	889 (NO 3-7)	0537	ARCO	Sedco 708	1	08/04/84	11/30/84
	70	Bertha	616 (NO 3-1)	0466	Mobil	Sedco 712	1	09/29/84	11/03/84
	70	Wolf Lake	631 (NO 3-7)	0511	ARCO	Sedco 708	1	11/07/84	12/14/84
							1A	12/17/84	02/14/85
	70	Fern	467 (NN 3-1)	0434	SWEPI	Ocean Odyssey	1	11/20/84	01/24/85
	70	Camelot	811 (NN 3-1)	0477	Gulf	Doo Sung	1	11/27/84	01/23/85
	70	Monkshood	604 (NN 3-1)	0463	SWEPI	Ocean Odyssey	1	01/26/85	03/26/85

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TABLE 9.—Alaska OCS Region drilling history through December 1985—Continued

Planning area	Sale	Prospect[1]	Block no./OPD	Lease no. (OCS-Y)	Operator	Drilling unit	Well	Spud date	Date plugged and abandoned
Norton Basin	57	Chugach	267 (NP 3-2)	0414	Exxon	Middleton	1	06/19/84	07/23/84
	57	Birch	949 (NQ 3-7)	0436	ARCO	Key Hawaii	1	06/25/84	08/19/84
	57	Teton	448 (NP 3-2)	0430	Exxon	Middleton	1	07/25/84	08/16/84
	57	Cascade	54 (NP 3-2)	0398	Exxon	Key Hawaii	1	07/02/85	07/23/85
	57	Yellow Pup	182 (NP 3-2)	0407	Exxon	Key Hawaii	1	07/23/85	08/11/85
	57	Chugach	361 (NP 3-2)	0425	Exxon	Key Hawaii	1	08/13/85	08/26/85
Beaufort Sea	BF	Beechy Pt.	654 (NR 6-3)	0191	Exxon	Gravel Island	1*	11/01/81	03/31/82
							2*	12/27/81	03/15/82
	BF	Tern Island	744 (NR 6-3)	0195	SWEPI	Gravel Island	1*	05/28/82	09/18/82
	BF	Tern Island	745 (NR 6-3)	0196	SWEPI	Gravel Island	1*	10/16/82	03/03/83
	BF	Seal Island U.	516/560 (NR 6-3)	0181	SWEPI	Gravel Island	1*	02/04/84	06/30/84
	71	Mukluk	280 (NR 5-4)	0334	Sohio	Gravel Island	1	11/01/83	01/24/85
	71	Antares	971 (NR 5-2)	0280	Exxon	CIDS	1	11/01/84	01/18/85
							2	01/19/85	04/13/85
	BF	Seal Island	672/673/674 (NR 6-3)	0180	SWEPI	Gravel Island	1	02/22/85	07/22/85
	87	Hammerhead	624 (NR 6-4)	0849	Union	Explorer II	1	08/10/85	09/25/85
	71	Harvard	423/424 (NR 6-3)	0370	SWEPI	Gravel Island	1	09/02/85	—
	87	Orion	8 (NR 5-4)	0804	Exxon	CIDS	1	11/10/85	12/15/85
Navarin Basin	83	Nicole	414 (NO 1-2)	0707	Amoco	Ocean Odyssey	1	06/07/85	08/27/85
	83	Redwood	693 (NP 1-7)	0599	Exxon	Doo Sung	1	06/14/85	08/30/85
	83	Danielle	227 (NP 1-8)	0639	Amoco	Sedco 708	1	06/19/85	08/20/85
	83	Packard	637 (NP 1-7)	0586	ARCO	Sedco 712	1	08/03/85	10/21/85
	83	George	157 (NP 1-7)	0560	Amoco	Sedco 708	1	08/22/85	10/08/85
	83	Redwood	606 (NP 1-7)	0583	Exxon	Doo Sung	1	08/31/85	10/12/85
	83	Misha	197 (NO 1-1)	0673	Amoco	Ocean Odyssey	1	08/31/85	10/21/85
	83	Nancy	723 (NO 1-2)	0719	Amoco	Sedco 708	1	10/12/85	11/23/85

[1] Prospect names are given by industry. The same structure may have more than one prospect name as various offshore operators will have different prospect names for a single structure.

*Determined "producible" by MMS.

SOURCES: MMS, 1985b; 1985c; 1985d.

While concerns have been raised about the safety of using various mobile drilling units offshore in the Arctic, use of the **Glomar Beaufort Sea I**--the Concrete Island Drilling System (CIDS)--over the past winter and experiences with mobile drilling platforms in Canada are increasingly allaying fears and providing evidence of the year-round utility of mobile units built for Arctic seas.

Several plans for exploratory drilling projects in the Beaufort Sea OCS have employed a variety of innovative drilling systems. Exxon initiated drilling on the Antares prospect (OCS-Y 0280) on November 1, 1984, using CIDS. The first well recovered noncommercial traces of oil from a probable Sadlerochit zone below 7,500 feet. This well was plugged and abandoned on January 18, 1985, having reached a total depth of 8,450 feet. Exxon drilled a second well on OCS-Y 280, skidding the Parker Drilling Company's Rig 217 about 8 feet across the drilling platform of CIDS (Oil and Gas Journal, 1985a). The second well, spudded on January 19, 1985, and plugged and abandoned on April 13, 1985, also discovered no commercial reserves of hydrocarbons. On November 10, 1985, a third well was spudded from CIDS. Exxon initiated exploratory drilling of its Orion prospect on OCS-Y 804, a few miles off Point Halkett in the Beaufort Sea. This well was plugged and abandoned on December 15, 1985.

The most remarkable facet of Exxon's work on the Antares project was the successful use of the CIDS mobile drilling structure. The Antares well became the first well drilled in the Alaskan Beaufort OCS from a platform other than a gravel island. Structure and design of CIDS were discussed extensively in the **Arctic Summary Report, January 1985** (Lynch, Slitor, and Rudolph, 1985).

Shell Western Exploration and Production, Inc. (SWEPI) initiated exploratory drilling on lease OCS-Y 370, the Harvard prospect, on September 2, 1985. As of December 31, 1985, drilling operations were still underway from the Sandpiper gravel island approximately 6 miles from shore. The island was constructed between November 1984 and June 1985 and has a top diameter of 400 feet. Sandpiper, built in about 50 feet of water at a cost of $28 million, is in the deepest water of any gravel island built to date in the U.S. Beaufort Sea (Billy Vehnekamp, 1985, SWEPI, Anchorage, August, oral commun.).

Exploration drilling on the Hammerhead prospect began on August 10, 1985, by Unocal using the Canmar **Explorer II.** The Canmar drillship is a converted U.S. Navy storm class Cimari cargo ship with a steel-reinforced hull for work in waters pervaded with sea ice. With support from icebreakers, the Canmar **Explorer II** has the capability to work in Arctic waters up to 145 days per year. When drilling, the ship is moored with eight lines equipped with remote anchor release units. Prior to spudding the first Hammerhead prospect well in August 1985, ice encroached on the location, and the **Explorer II** was moved efficiently and safely to avoid any potential problems. The Canmar vessel has been used to drill many wells in the Canadian Arctic, though the Hammerhead well marks its first use in U.S. waters. The locations of the prospects discussed are shown on figure 12.

Plans also call for exploration drilling in the near future on the prospects listed below. While plans for work in the Beaufort Sea often change and exploration plans submitted to MMS are not a commitment to go ahead with the work proposed, these plans at least reflect industry interests in the near future and the technologies operators are employing.

- **Corona** will be drilled on OCS-Y 871 north of Camden Bay by SWEPI, using the Canmar **Explorer II** when it has completed the Hammerhead well;

- **Mars** is to be drilled on OCS-Y 302 northeast of Cape Halkett

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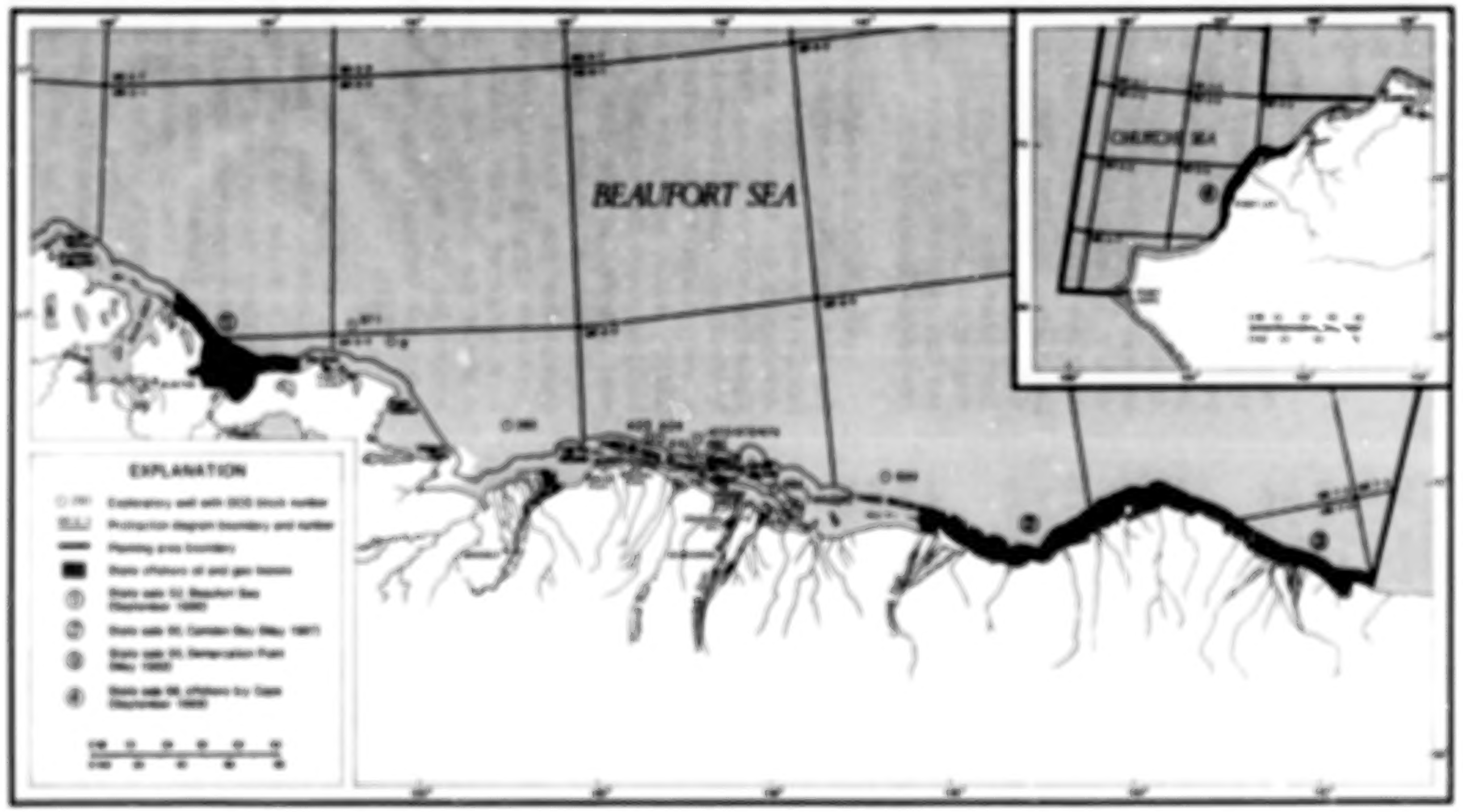

FIGURE 12.--Beaufort Sea OCS Planning Area exploratory wells and locations of areas being considered for State offshore sales in the Arctic.

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by Amoco. The exploratory well will be spudded from an ice island 5 miles offshore in 26 feet of water. The well, to be worked on between February 1 and April 30, 1986, will be supported from a temporary base on Cape Halkett.

- **Eric** is to be drilled in Federal waters on lease number OCS-Y 912 northeast of Kaktovik by Amoco, using the semisubmersible Beaudril **Kulluk** (fig. 13) constructed for extended-season drilling in Arctic waters; and

- **Phoenix** will be drilled by Tenneco about 15 miles northwest of Oliktok Point on OCS-Y 339, using the Single Steel Drilling Caisson (SSDC) (see discussion below and fig. 14) or a gravel island yet to be constructed (Oil and Gas Journal, 1985c).

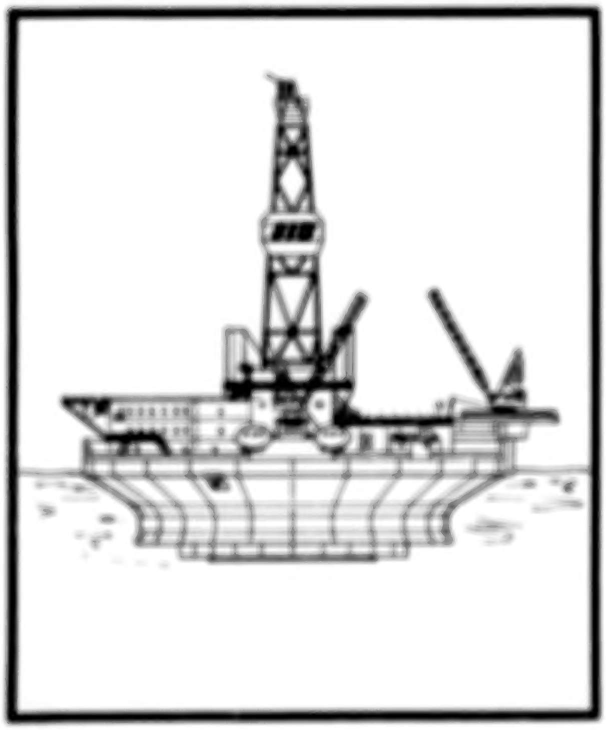

FIGURE 13.--The conically shaped semisubmersible Beaudril **Kulluk** built for extended-season drilling in Arctic waters (Beaudril, Ltd., 1985).

The Beaudril **Kulluk**, an innovative design from Canada expected to be used in the near future to spud Amoco's Eric prospect, is a conically shaped semisubmersible. **Kulluk** is the first floating vessel designed and constructed for extended-season drilling offshore in the Arctic. The vessel is 265 feet in diameter with a double-walled, inward-sloping hull that measures 61 feet from top to bottom. With this design, **Kulluk** can withstand first-year ice floes of up to 4 feet in thickness. With 12 mooring lines, the vessel can operate in waters from 80 to 600 feet deep (Beaudril Ltd., 1985).

The SSDC, a second innovative design for the Beaufort, is expected to spud Tenneco's Phoenix prospect. The SSDC was developed by Canmar and first used in Canadian waters during 1982. The vessel is a modified, concrete-reinforced hull from a very large crude carrier tanker. The SSDC, when set down on a gravel berm built up from the seafloor or set on a steel mat placed on the sea bottom, has the capability to conduct exploratory drilling operations year round. With the use of berms or varying mats, the SSDC can work in a range of water depths. The arrangement of the drilling rig on the vessel also allows for the drilling of up to eight wells from one location (Canmar Marine Drilling Ltd., 1985).

In addition to these plans for work in the Beaufort, Sohio Alaska has signed a contract to use the SSDC during the 1987-88 drilling season and has an option to extend the contract through the 1988-89 season. Tenneco plans to use the SSDC during the 1986-87 drilling season (Sohio Intercom, 1985). Also of note, SWEPI, Amoco, and Unocal have funded design work on a bottom-founded exploratory drilling platform for use in waters from 56 to 130 feet deep (fig. 15). A structure of this design would be able to work on any of

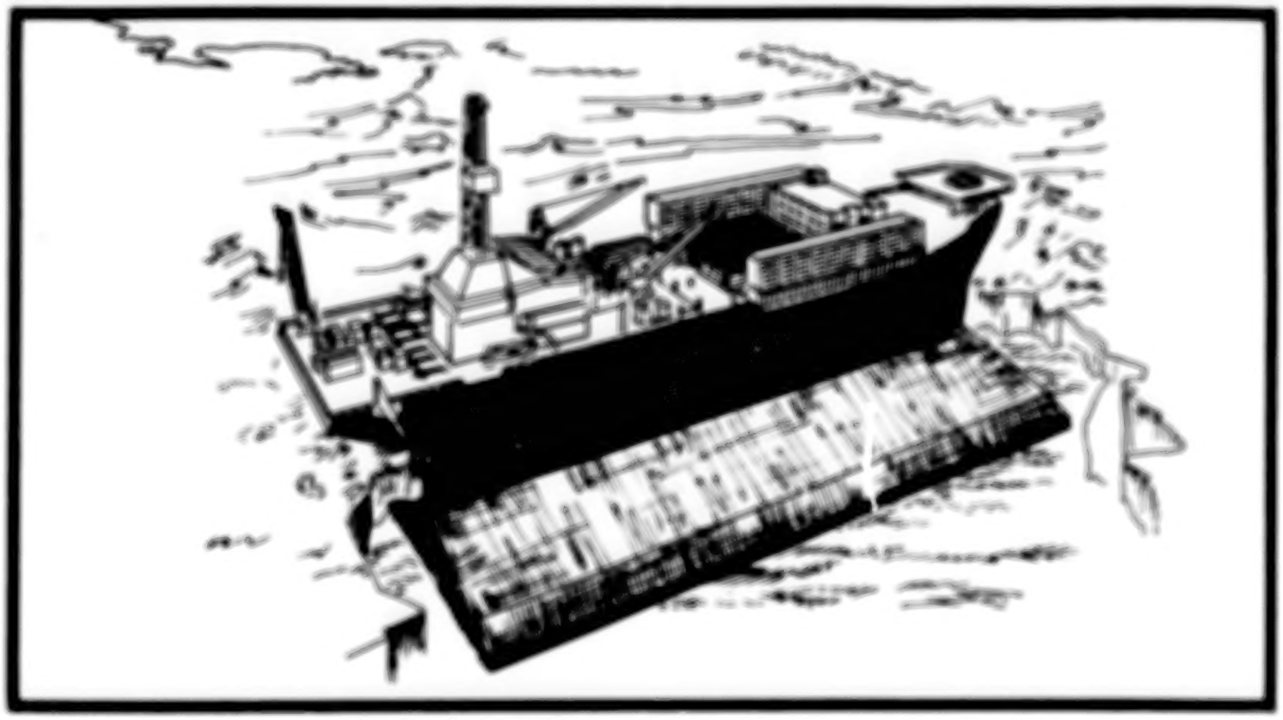

FIGURE 14.--The Single Steel Drilling Caisson set on a steel mat resting on the Arctic Ocean floor (Canmar Marine Drilling Ltd., 1985).

these companies' current prospects--Corona, Hammerhead, or Eric--and could be built for use as early as mid-1987. No decision has been announced yet as to the companies' plans.

With the continuing influx of new arctic technologies for offshore drilling in the Alaskan Beaufort and the large number of prospects yet to be explored, it is expected that work in this area of the Alaska OCS will continue at a strong pace. While restrictions designed by MMS to limit interference with the migration of the endangered bowhead whale through the Beaufort and severe arctic environment conditions temporarily limit exploratory work, operators are seizing their opportunities to explore with increasing efficiency.

Bering Sea Subregion Exploratory Activity

NORTON BASIN DRILLING. Since the first lease sale in the Norton Basin Planning Area, Lease Sale 57 conducted on March 15, 1983, six wells have been drilled on Norton Basin OCS leases. Exxon, the largest leaseholder from the sale, has drilled five of the wells, ARCO Alaska the other one (Alaska Construction and Oil, 1984a). Figure 16 depicts the locations of these wells, and table 9, p. 40, presents data on them. There have been no announcements of commercial discoveries from the six wells and it is uncertain whether drilling will take place on other Lease Sale 57 holdings during the 1986 summer drilling season.

ST. GEORGE BASIN DRILLING. Lease Sale 70 was the first offering of St. George Basin OCS leases. The sale resulted in the award of 96 leases, and industry interest in initiating exploratory drilling in the area was high.

Ten wells were spudded between June 29, 1984, and January 26, 1985, by six different offshore operators to explore the basin. Using five semisubmersible rig built for operation in harsh offshore environments, exploration was conducted at a

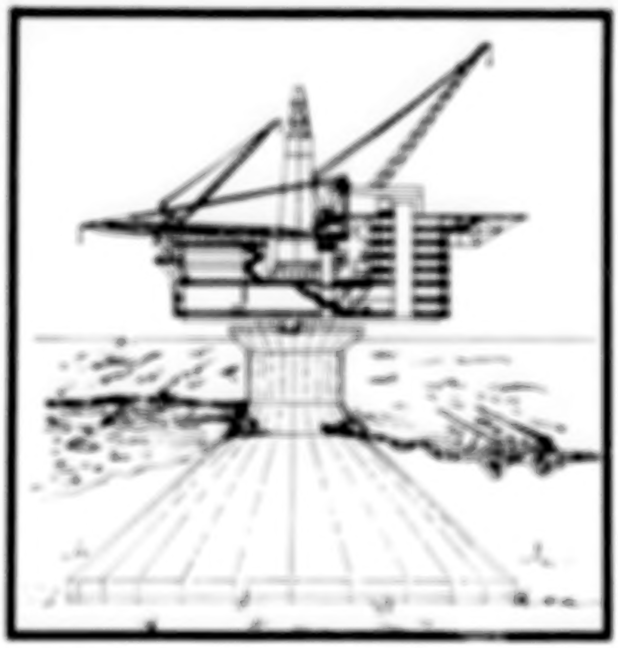

FIGURE 15.--Design proposal developed by SWEPI, Amoco, and Unocal for an Arctic exploration drilling platform (courtesy of SWEPI).

swift pace compared to work in other Alaska OCS planning areas.

Details on these exploratory wells are offered in table 9, p. 40, and figure 17 depicts the locations of the wells in the St. George Basin OCS Planning Area.

Results from the 10 wells drilled in the St. George Basin area have not been made public (Pacific OCS News, 1983a). St. George Lease Sale 89, scheduled for September 1983, was delayed on September 26, 1983, because of indications that industry interest in further leasing in the area was low. The MMS will continue to evaluate industry interest, however, and the sale may be rescheduled in 1986. Prospects for additional drilling in the St. George Basin area prior to the conduct of a second sale appear to be low.

NAVARIN BASIN DRILLING. The first Navarin Basin OCS lease sale, held on April 17, 1984, offered a tremendous challenge to offshore operators. The Navarin Basin area is subject to extremely harsh and unpredictable weather conditions. Ice incursion occurs from 6 to 8 months of the year, with ice during particularly cold winters not receding until mid- to late June. During the late winter and spring, the area is pounded by fierce storms that have gathered strength crossing the Pacific Ocean. In late spring and summer, thick fog commonly grounds all aircraft.

Logistics are a tremendous problem for offshore operators in the Navarin, for in addition to the weather, the basin is extremely remote. Prospects in the planning area are generally at least 370 miles from Dutch Harbor, the major staging point for exploratory work, and more than 275 miles from St. Paul Island, the nearest land base from which industry is allowed to operate. Further information on the challenges and innovations required for work in the Navarin is presented in chapter 4 of this report.

The Navarin Basin is viewed by many petroleum geologists as the most prospective in the Bering Sea, and although conditions are harsh, operators are committed to overcoming the challenges. In Navarin Basin Lease Sale 83, operators bid on 186 blocks exposing more than $631 million in high bids. In the sale, the two dozen participating oil companies submitted 425 bids, more than in any other lease sale held in the Alaska OCS Region. Sale bidding indicated the existence of at least 17 geologic plays in the area, a number that could require at least three or four seasons of drilling to explore (Oil and Gas Journal, 1983b).

Resource estimates made by MMS predict that up to 1.3 billion barrels of oil and 1.58 trillion cubic feet of gas may exist under the basin. Expectations were raised in April 1984 when the U.S. Geological Survey discovered a large plume of gas escaping from the seafloor in the area. The plume extends about 180 feet above the seabed in approximately 340 feet of water, indicating a large volume of gas (Alaska Construction and Oil, 1984b). The

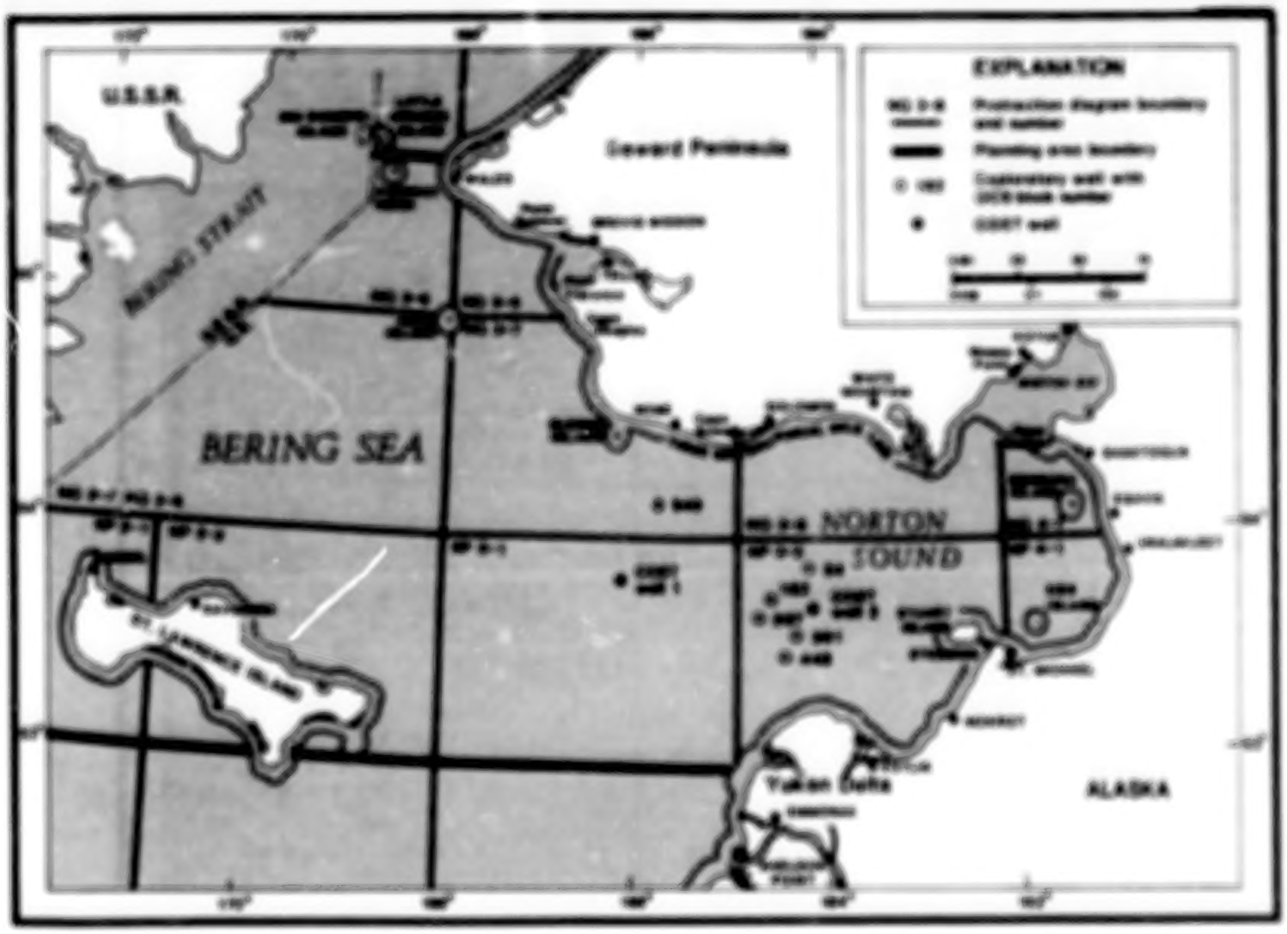

FIGURE 16.—Norton Basin OCS Planning Area exploratory wells.

plume, however, rises from submerged lands whose sovereignty is in dispute between the United States and the Soviet Union. Information on Navarin Basin exploratory wells is presented in table 9, p. 40, and figure 18 depicts the locations of the wells.

With all the wells drilled to date in the Navarin, very little public information regarding results has been available. A number of factors contribute to this situation, including the high costs and levels of difficulty in working in the Navarin, the fact that a second Navarin OCS sale is scheduled for September 1986, and a State Department request for secrecy as negotiations continue with the Soviet Union over disputed lands near the Navarin drilling activity (Pacific OCS News, 1983b).

While no public reports of the results from Navarin drilling are available, industry interest in the planning area is strong, even with the tremendous climatic and logistical problems the Navarin presents. With their drilling during the 1983 season, offshore operators have overcome the obstacles to Navarin exploration. It is expected that in the coming years exploration of the numerous untested prospects in the Navarin will continue; however, a recent Federal appeals court ruling puts plans for near-term drilling in jeopardy.

On April 25, 1983, the Village of Gambell on St. Lawrence Island and Nunam Kitlutsisti filed suit (Civ. No. A83-201) in the U.S. District Court for Alaska to (1) enjoin all activities resulting from Sale 83, Navarin Basin, (2) declare Sale 83 to be

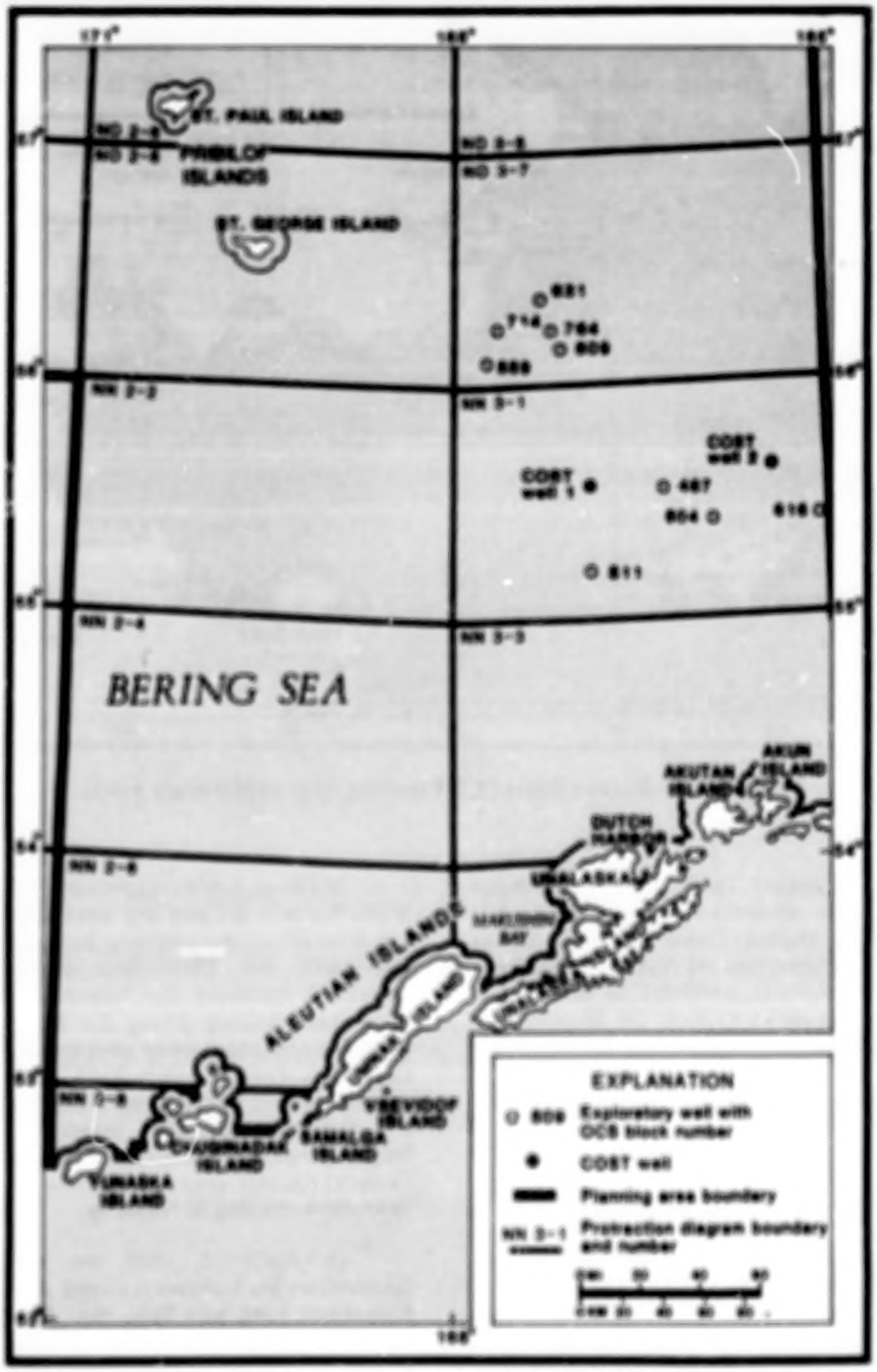

FIGURE 17.—St. George Basin OCS Planning Area exploratory wells.

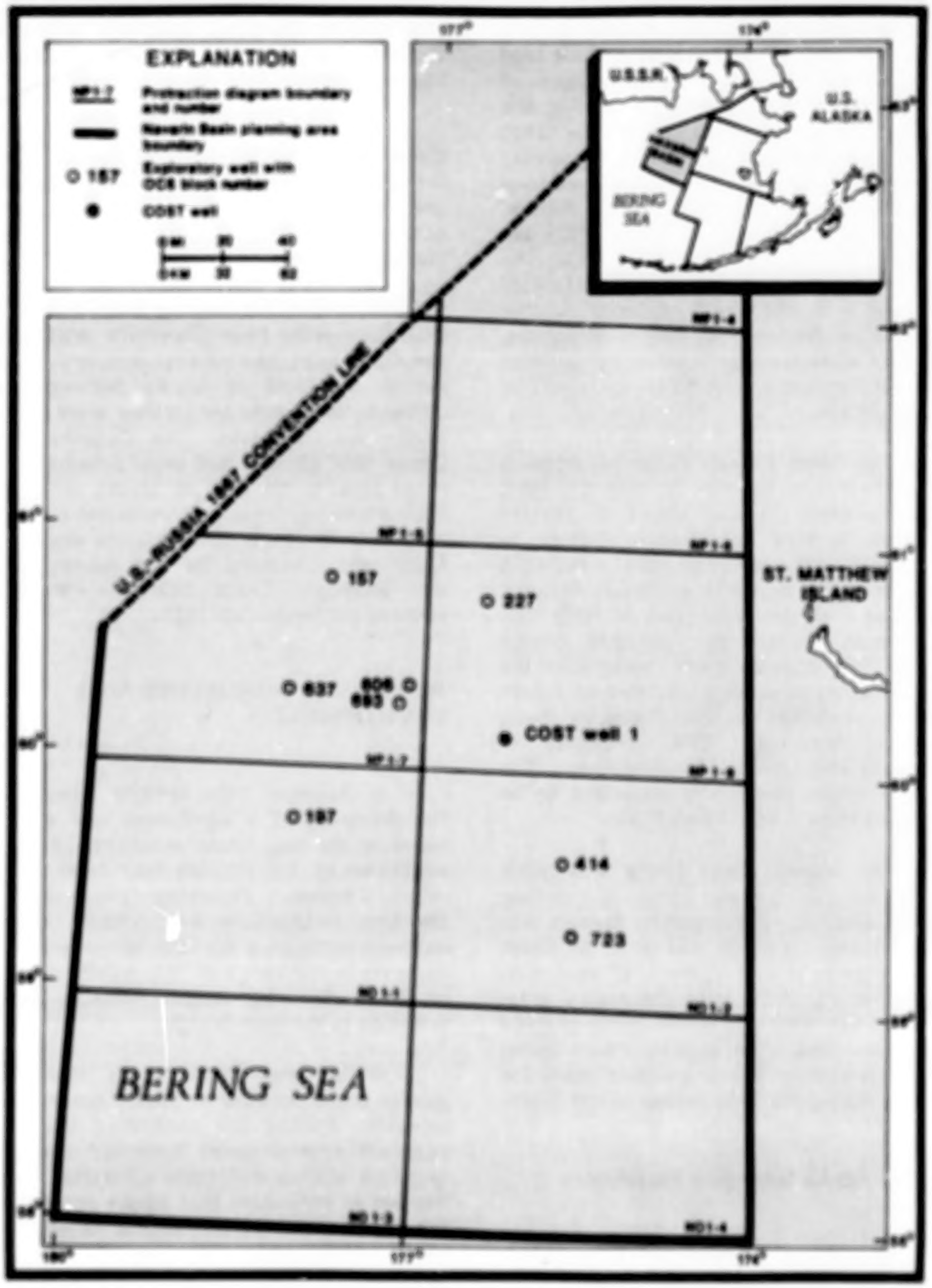

FIGURE 18.--Navarin Basin OCS Planning Area exploratory wells.

invalid, and (3) void all leases resulting from the sale. The plaintiffs argued that DOI had failed to evaluate the impacts of the sale on Natives' aboriginal hunting and fishing rights as required by the 1980 Alaska National Interest Lands Conservation Act (ANILCA). The DOI argued that the 1980 act was applicable within Alaska, but not offshore on the Federal OCS beyond the State's 3-mile territorial sea. The district court found that the Secretary of the Interior should have considered possible impacts on Native subsistence activities, but that injunctions on exploration activity and nullification of Sale 83 leases would be inappropriate.

The Ninth Circuit Court of Appeals in San Francisco ruled on October 26, 1985, that the 1980 act was passed to protect Alaskan Natives' subsistence culture in cases such as the one presented by the OCS lease sale and that in these cases national concerns over the protection of their culture must prevail over possible energy needs. The appeals court ruling asks the district court to place injunctions on future drilling activities in the Navarin Basin Planning Area until DOI completes its responsibilities under the ANILCA. The appeals court decision is expected to be appealed (New York Times, 1985).

The appeals court ruling was made late in the 1985 Navarin Basin OCS drilling season, and only one operator, Amoco, was still drilling. Amoco was able to finish drilling its final well of the 1985 season on November 23, 1985, when the Nancy prospect (OCS-Y 719) was permanently plugged and abandoned. The appeals court ruling does, however, put into question plans for drilling during the 1986 season in the Navarin.

Gulf of Alaska Subregion Exploratory Activity

Late in 1984 and into January 1985, Chevron U.S.A. spudded three exploratory wells in the Cook Inlet Planning Area. Previous drilling in the Gulf of Alaska Subregion had concluded with a May-June 1980 well in the Cook Inlet and an April-October 1983 well in the Gulf of Alaska Planning Area.

Data on the exploration wells in the Cook Inlet are in table 9, p. 40. The locations of these wells are shown on figure 19, and further information on support activities related to these projects is included in chapter 4.

As there were no reported commercial discoveries from Chevron's drilling in the Cook Inlet and general industry interest in the Gulf of Alaska Subregion is currently low, plans for further work in the region are uncertain. The October 1984 Lease Sale 88 that had been scheduled to offer lands in the Gulf of Alaska and Cook Inlet Planning Areas was deferred because of a lack of industry interest; the next OCS lease sale scheduled for the subregion is the Shumagin Lease Sale 86 currently planned for December 1987.

ALASKA OCS DISCOVERIES AND DEVELOPMENT

In January 1984, SWEPI announced the discovery of a significant new oil reserve on its Seal Island prospect, 12 miles northwest of the Prudhoe Bay field and 3 miles offshore. Following completion of the first confirmation well, SWEPI conservatively estimated that the discovery held reserves in the range of 300 million barrels of oil--one of the largest finds in North America in the past decade.

While Seal Island is a manmade gravel island located in State waters, delineation drilling has confirmed that the reservoir extends under federally managed disputed offshore waters. Further study has led to estimates that 12-15 percent of the reserves are within Federal jurisdiction (Billy Vehnekamp, 1985, SWEPI, Anchorage, August, oral commun.). To date, this discovery is the only potentially commercially viable reserve of oil found in the Alaska OCS Region.

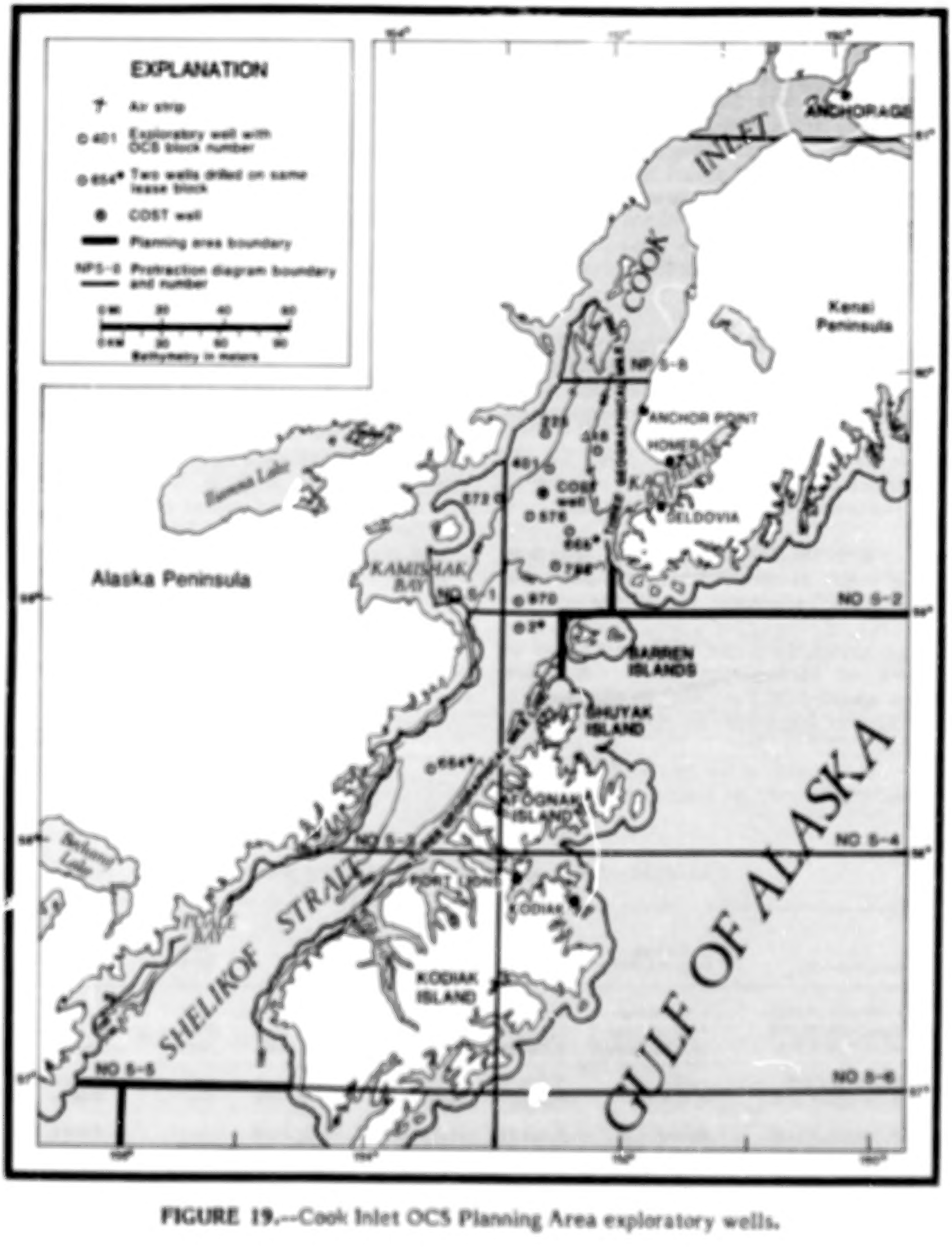

FIGURE 19.--Cook Inlet OCS Planning Area exploratory wells.

Seal Island, constructed in about 40 feet of water, required placement of 700,000 cubic yards of gravel and has a top diameter of 400 feet. The gravel was moved by truck across ice roads between December 1981 and August 1982. Seal Island was the first gravel island constructed outside the barrier islands in the U.S. Beaufort Sea. Lease statistics for the prospect are presented in table 10. For an outline of Seal Island drilling history, see the sidebar, p. 53.

With completion of the fourth well from Seal Island in July 1985, SWEPI ended delineation drilling on the prospect. Following completion of Amerada Hess' drilling from Northstar Island, 5 miles to the west of Seal Island, further plans for the prospect will be developed by the companies involved as partners in the unit.

With its Northstar drilling, Amerada Hess hopes to confirm an extension of the Seal Island reservoir. During the summer of 1985, the company was completing construction of Northstar in about 40 feet of water on State Tract BF-46. Amerada Hess spudded its first well on October 12, 1985, and expected to drill to approximately 12,250 feet. The company has permits to drill up to five wells from the location (Oil and Gas Journal, 1985c).

STATE OF ALASKA OFFSHORE DEVELOPMENT

Within Alaska, the State Department of Natural Resources (DNR), Division of Oil and Gas, conducts regular lease sales for hydrocarbon development rights on State lands, both on- and offshore. Alaska has jurisdiction from the low-tide line onshore to a point 3 geographic miles offshore where the Federal OCS begins. The State leasing program is run under a 5-year leasing schedule, very similar to the process employed by the U.S. DOI for the leasing of OCS lands. The State publishes an informative annual report for the legislature on the 5-year program covering a wide range of data related to upcoming lease sales as well as the process for leasing. The most recent report, entitled "Five-Year Oil and Gas Leasing Program, January 1985," is available to the public from

Division of Oil and Gas
Alaska Department of Natural
Resources
Pouch 7-034
Frontier Building
C Street and 36th Avenue
Anchorage, AK 99510.

TABLE 10.—Lease statistics for Seal Island prospect

Block/lease no.	Working interest owner	Acres	Bonus (dollars)	Royalty	Net profits (percent)	Lessor
BF-47/ADL-312799	Amerada Hess	4,672.37	3,913,324	20%	91.2	State
BF-46/ADL-312798	Amerada Hess	4,392.82	3,843,718	20%	93.2	State
BF-25/OCS-Y 0181	SWEPI (operator) 90%/Murphy 10%	5,242.64	60,890,000	Sliding scale royalty	—	Federal
BF-2/OCS-Y 0173	Amoco	3,309.39	11,090,030	Sliding scale	—	Federal
BF-23/OCS-Y 0179	Amoco	2,231.93	20,190,993	Sliding scale royalty	—	Federal
BF-26/OCS-Y 0180	Amoco	4,010.68	13,030,900	Sliding scale royalty	—	Federal
BF-56/ADL-312808	Texas Eastern	3,432.92	3,003,803	20%	83.23978	State
BF-57/ADL-312809	Texas Eastern	3,301.38	4,638,708	20%	83.23978	State

SOURCE: Billy Velneekamp, 1985, SWEPI, Anchorage, August, oral commun.

Seal Island Drilling History

First well (BF-47-1)
- spudded on June 1, 1983
- rig release date (well completed): January 29, 1984
- discovered oil from depths below 12,750 feet as measured in the well bore tests
- showed 600-5,000 barrels per day (bpd) of 40-degree American Petroleum Institute (API) gravity oil

Second well (OCS-Y 181 No. 1)
- spudded on February 3, 1984
- rig release date (well completed): June 29, 1984
- first appraisal well
- discovered oil from a depth of approximately 12,700 feet as measured in the well bore tests
- showed up to 5,000 bpd of 40-degree API gravity oil

Third well (BF-57-1)
- spudded on July 9, 1984
- rig release date (well completed): February 10, 1985
- second appraisal well
- discovered oil from a depth of 14,490 feet as measured in the well bore
- tested at rates up to 2,600 bpd of 40-degree API gravity oil

Fourth well (OCS-Y 180 No. 1)
- spudded on February 23, 1985
- reached total depth of 16,090 feet in July 1985
- rig release date (well completed): July 22, 1985

SOURCE: Billy Vennecamp, 1985, SWEPI, Anchorage, October, oral commun.

In 1979, the State established a program for evaluating the economic, social, and environmental impacts of forthcoming State oil and gas lease sales. Under the established procedures, DNR's Division of Oil and Gas sent requests for information and comments on particular sales to affected community and borough governments as well as to special interest groups in the region of the sale. Similar requests were also sent to the following State agencies and offices: the Commerce and Economic Development Department, the Community and Regional Affairs Department, the Division of Governmental Coordination, the Environmental Conservation Department, the Fish and Game Department, the Labor Department, the Office of the Attorney General, the Revenue Department, and the Transportation and Public Facilities Department. Responses were then compiled into a social, economic, and environmental analysis (SEEA) document.

Through 1984, DNR, in response to growing concerns that the SEEA documents were not effectively serving to assess the potential impacts of State sales, considered alternatives to the often unread publications. Beginning in fiscal year 1986, DNR is initiating a Preleasing Public Outreach Program that is a unique experiment to involve the community in public land leasing decisions (Alaska Department of Natural Resources, 1985).

Two videotapes, an issues summary, and public workshops will replace the SEEA documents. One videotape will summarize the oil and gas leasing, exploration, development, and production processes and their general social, economic, and environmental effects. To address area-specific concerns, the Division of Oil and Gas staff, working with other concerned agencies, will produce a supplemental videotape describing sale-specific issues. The staff also will summarize all the related issues in a written document that will be distributed in the community along with the two videotapes. Following their distribution and viewing, the State will conduct public workshops designed to involve the community in the decisionmaking process.

The DNR hopes that through this experiment, Alaskans, who are often inundated with documents related to proposed projects, will be more informed about the State's leasing program (Alaska Department of Natural Resources, 1985).

Recent State Sales Offshore

The State of Alaska has conducted one lease sale of offshore lands during the 1984-85 period. On February 26, 1985, the DNR offered 65 tracts in the Cook Inlet for lease; all the tracts had previously been offered. Ten companies bid approximately $2.5 million for 50 of the 65 tracts offered. State officials were pleased with the results, finding them similar to those from previous sales in the Cook Inlet (Daily News-Miner (Fairbanks), 1985b).

ARCO Alaska was the most active bidder in the sale, offering $1.54 million for 20 tracts covering about 80,000 acres. Chevron U.S.A. was second in overall bids, offering just less then $890,000 for four offshore tracts.

Future State Sales Offshore

Under Alaska's 5-year oil and gas leasing program of January 1985 for on- and offshore State lands, six sales are scheduled for offshore tracts in the period from 1986 through 1989. Four of these offshore sales, offering lands from the shoreline out to the 3-geographical-mile territorial sea line, are to be conducted for submerged lands in the Arctic. They are

- Sale 52, Beaufort Sea (September 1986);
- Sale 50, Camden Bay (May 1987);
- Sale 55, Demarcation Point (May 1988); and
- Sale 58, Offshore Icy Cape (September 1989).

Areas under consideration for lease offering in these sales are depicted on figure 12, p. 43. One sale is planned to offer offshore lands in the Bering Sea:

- Sale 45, Hope Basin (May 1989).

Jurisdiction over Hope Bay is being disputed between the State and Federal governments, however, so the State's right to conduct this sale is currently in question. Sale 45 was originally planned for 1984 but was rescheduled by DNR to allow more time to resolve the sovereignty question.

The State will also conduct one sale for submerged lands in the Gulf of Alaska/Cook Inlet area:

- Saie 49, Cook Inlet (May 1986).

The full schedules for these sales and their prelease milestones are shown in figure 20.

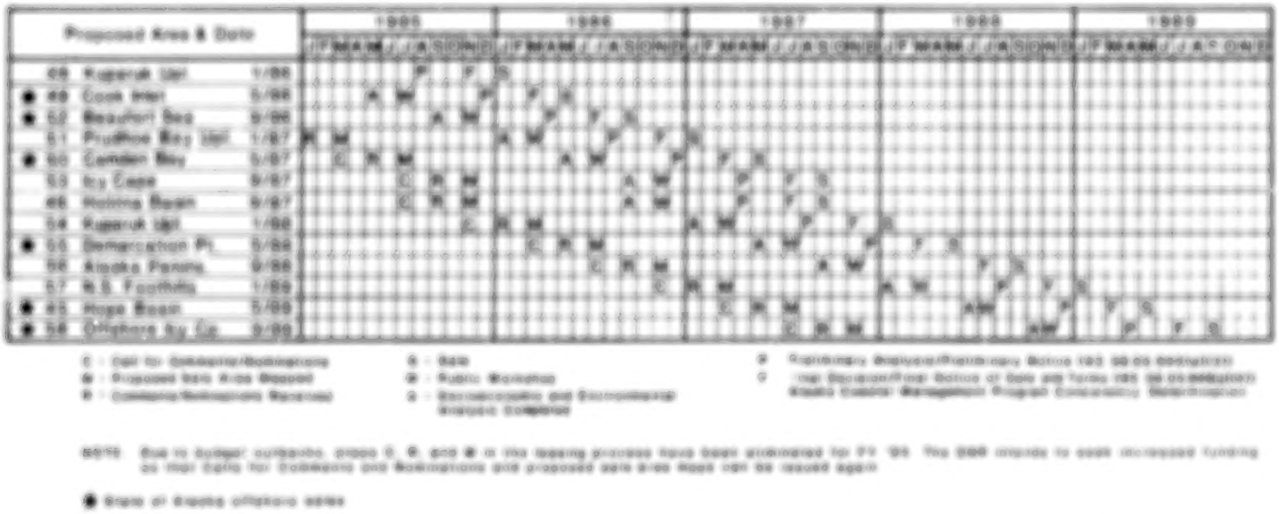

FIGURE 20.--State of Alaska lease sale schedule showing significant presale events (Alaska Department of Natural Resources, 1985).

Exploration in State Waters

Exploratory work in Alaska State waters during 1984 and 1985 has taken place in the Beaufort Sea region, both inside the coastal barrier islands off the North Slope and outside the islands in open seas. As exploration drilling within 3 miles of land generally is in shallower waters than work initiated on the OCS, there is less incentive to use mobile drilling units on State submerged lands. Where water depths are less than about 50 feet, gravel islands, especially those close to onshore sources of gravel, remain more cost effective than the innovative, high-technology mobile units just being introduced on the Beaufort Sea OCS.

Table 11 presents information on gravel islands constructed to date in the Arctic, both in State and Federal waters.

TABLE 11.—Artificial islands constructed off Alaska

Island name	Company	Type	Year constructed	Approximate Water depth (ft)	Construction technique	Fill volume (cubic yards)	Cost (dollars in millions)
Constructed in State waters							
Harrison Bay #1	Union	Bottom-founded ice	1977	10	Top flood	N/A	Not available
Sag Delta #3-4	Sohio	Gravel	1977-78	3	Truck	52,000	Not available
Niakuk #3	Sohio	Gravel	1978-79	10	Truck	138,000	Not available
Experimental Ice Island	Exxon	Bottom-founded ice	1979	10	Top flood	N/A	Not available
Duck Island #1	Exxon	Gravel	1977-78	3	Truck	100,000	Not available
Duck Island #3	Exxon	Gravel	1980-81	10	Truck	180,000	Not available
Endeavor Island Sag 7-9-10	Sohio	Gravel	1980	10	Barge	164,000	Not available
Resolution Island Sag 8	Sohio	Gravel	1980	7	Barge	131,000	Not available
Seal Island*	Shell	Gravel	1981-82	40	Truck	700,000	$26.2
Goose A	Shell	Gravel	1982-83	7	Truck	156,000	$16
Cross Island	Gulf-Tenneco	Gravel	1982-83	3	Truck; constructed off a natural island	127,500	Not available
Niakuk #4	Sohio	Gravel	1983-84	3	Truck	70,000	Not available
Endicott Island Project-3 islands (1 built)	Sohio	Gravel	1984-86	13	Truck	7,000,000	Not available
Lisburne (Prudhoe Bay)**	ARCO	Gravel	1984-85	13	Truck	300,000	Not available
North Star	Amerada-Hess	Gravel	1984-85	40	Truck	1,000,000	Not available
Ice Island**	Sohio	Ice	1985	40	Pump and spray	1,300,000	Not available
Constructed on Federal OCS							
Beechey Point 1&2 OCS-Y 0191	Exxon	Gravel	1980-81	20	Truck	310,000	$20
Tern 1 & 2 OCS-Y 0195, 0196	Shell	Gravel	1981-82	20	Truck	313,000	$18
Mukluk OCS-Y 0344	Sohio	Gravel	1982-83	40	Barge	1,330,000	$100
Sandpiper OCS-Y 0370	Shell	Gravel	1984-85	40	Truck	812,000	$27

N/A = Not applicable.
*Two Federal wells (OCS-Y 0180 #1 and OCS-Y 0181 #1) were drilled from this island.
**Proposed.
SOURCE: MMS, Alaska OCS Regional Office, 1985b.

Figure 21 shows the locations of those islands.

Development in State Waters

ENDICOTT DEVELOPMENT PROJECT. On May 5, 1982, Sohio and Exxon announced tentative plans to develop discoveries made in the Sag River/Duck Island area. The companies' plans, named the Endicott Development Project, were to tap the Endicott hydrocarbon reservoir, which is estimated to contain recoverable resources of 350 million barrels of oil and 800 billion cubic feet of natural gas. The proposed production area is 15 miles east of Prudhoe Bay and approximately 2.5 miles offshore. It covers several tracts leased by the State in various sales, including the Joint Federal-State Beaufort Sea Lease Sale. Five oil companies--Sohio, Exxon, ARCO Alaska, Union, and Amoco--and four Native regional corporations--Doyon Ltd., Cook Inlet, Northwest Alaska, and Sealaska--hold leases in the area.

Sohio Alaska, operator of the Endicott project, proceeded with development only after significant measures were taken to limit project costs. With 350 million barrels of oil recoverable (at a 35-percent recovery rate), the company saw the project as only marginally profitable. Estimated costs for development are just over $2 billion (Bob Hartzler, 1985, Sohio, Prudhoe Bay, August, oral commun.).

As plans for the project developed, a critical factor in limiting costs involved the construction of gravel causeways offshore to the production islands and determination of the width of breaches necessary to allow for the flow of Beaufort Sea waters along the coast. Efforts to minimize the environmental effects of the project in this regard often conflicted with efforts to minimize costs. Sohio stated on numerous occasions that the project could not be economically developed under several alternatives set out in the U.S. Corps of Engineers' environmental impact statement (EIS). Descriptions of the alternative development proposals for Endicott can be found in the **Arctic Summary Report, January 1985** (OCS Information Report MMS 85-0022).

As the permitting process for Endicott proceeded, the North Slope Borough sought 2,000 feet of breaches in the north-south causeway running out to the causeway connecting the two production islands (fig. 22). Concerns regarding the causeway centered on the effects it would have on the salinity, temperature, sedimentation rates, and ultimately the fisheries populations and Native subsistence lifestyles if water flows along the coasts were significantly altered.

The State approved a two-breachway plan, however, that called for a 500-foot breach close to shore and a 200-foot breach farther offshore. The Borough finally accepted this plan with the condition that Sohio implement a thorough environmental monitoring program and install additional breaches if significant impacts were identified. Based on these agreements, the U.S. Corps of Engineers gave the Endicott plan its final major permit approval on January 29, 1985 (Daily News-Miner (Fairbanks), 1985a).

The environmental monitoring program initiated by Sohio includes studies of fish, physical oceanography, ice movements, sedimentation, and erosion, as well as snow geese and caribou. Costs for the monitoring program's first year in 1985 are expected to range between $2.5 million and $3 million. The overall program is expected to continue for at least 7 years, with some facets extending throughout the lifetime of the field (Sohio Intercom, 1985).

The schedule for the Endicott project as currently planned is as follows:

- June 1983--begin preliminary design engineering.
- February 1985--begin construction of gravel causeways and islands.

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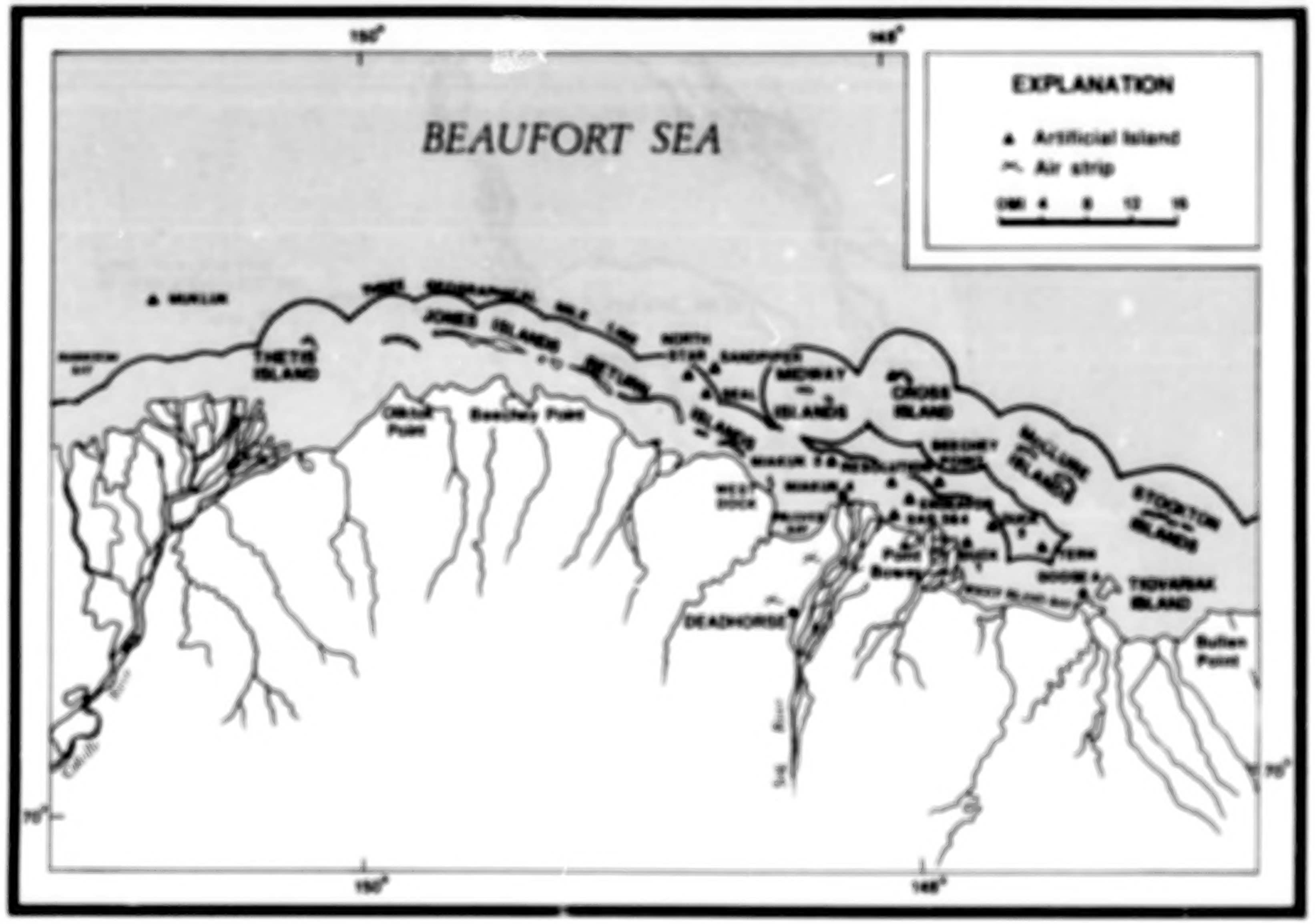

FIGURE 21.--Beaufort Sea artificial islands in Federal and State waters (MMS, Alaska OCS Region).

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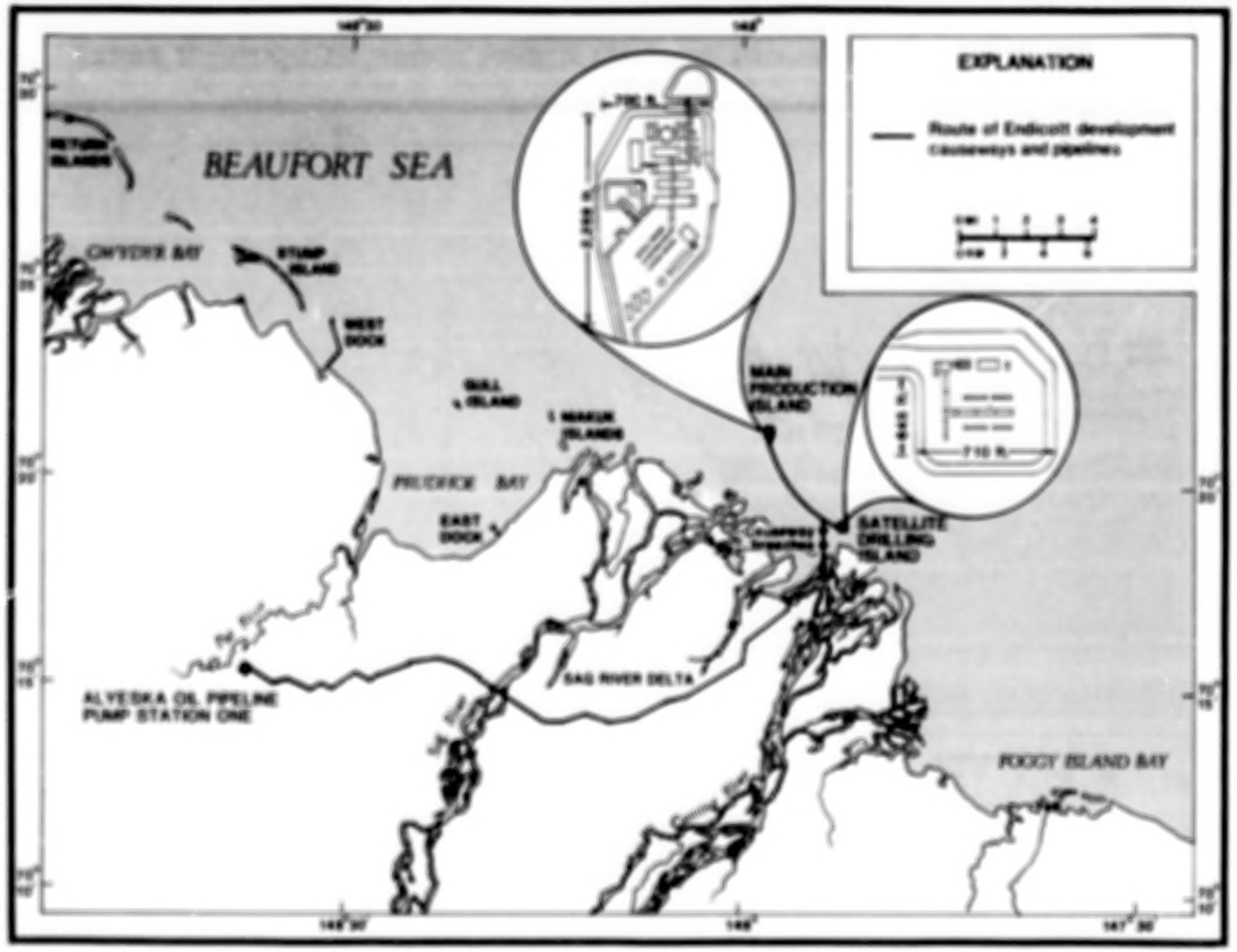

FIGURE 22.--Endicott Development Project islands, causeways, and pipeline routes (Sohio, 1985). ST

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- January 1986--begin pipeline construction.
- April 1986--begin drilling operations.
- July 1987--complete pipeline.
- Mid-1988--begin production.

While production will initiate with approximately 40 wells producing 100,000 barrels per day (bpd), eventually between 100 and 120 wells will be drilled from the islands.

LISBURNE DEVELOPMENT. On January 31, 1984, the board of directors of ARCO committed the company to developing the Lisburne oil field on the northwest edge of the Sadlerochit Formation. Lisburne was discovered in March 1968, at the same time as the main Prudhoe Bay field was discovered, but Lisburne has an extremely complicated carbonate formation that makes production work challenging. Estimates are that the reservoir holds between 1 billion and 3 billion barrels of oil. Interest in the field is split, with ARCO and Exxon holding about 40 percent each and Sohio Alaska holding the remaining 20 percent.

The complicated geology of Lisburne will necessitate the drilling of 180 wells from 6 new drill sites. Five of these sites will be onshore; the sixth (if approved by the Army Corps of Engineers) will be a gravel island approximately 13,000 feet offshore in Prudhoe Bay. A solid-fill gravel island causeway allowing for year-round vehicle access to the island, as well as cables and pipeline connections, is also planned. Phase I of the Lisburne plan may cost between $1.4 billion and $2 billion; production is expected at rates up to 100,000 bpd of oil that is somewhat heavier than the 28-degree API gravity oil currently flowing from the main Prudhoe Bay field.

Plans for Lisburne's offshore island base have been approved by both the State and North Slope Borough. Among the conditions for permit approval was an agreement by ARCO to undertake a fisheries enhancement program in the Beaufort if monitoring of the Lisburne causeway's environmental effects identified significant impacts.

State and local officials, in reviewing the plans for the Lisburne development's offshore construction, raised relatively fewer environmental concerns than had come up in the controversial approval process for the Endicott causeways and islands. Two significant differences were clear between the Lisburne and Endicott projects from an environmental standpoint. First, the Lisburne island and causeway are proposed for construction within Prudhoe Bay and are not expected to greatly affect the main long-shore coastal currents that nurture the majority of marine species off the North Shore. The Endicott causeway has been constructed in the path of this long-shore current, and while it has breaches, the causeway will alter coastal currents; its effects on varying marine species are uncertain.

Second, the Lisburne development, as proposed, would be constructed adjacent to areas that have already experienced high levels of oil industry development relative to nearly every other location on the North Shore, including those areas affected by the Endicott development.

ARCO is still awaiting approval of the Lisburne island and causeway by the U.S. Army Corps of Engineers, however. In August 1985, the Corps ruled that an EIS would have to be completed prior to any decision because the project could have significant environmental effects. ARCO had proposed completing a less comprehensive environmental assessment in light of the project's location in the bay. Completion of the EIS process for the Lisburne permits should require approximately a year. Construction of the island and causeway is expected to take approximately 2 years.

ARCO will move ahead with work on the five onshore drilling sites for the Lisburne reservoir without Corps approval of its offshore plans. This work should allow Lisburne to begin producing late in 1986 or early in 1987 at a rate of 40,000 bpd. Eventually Lisburne should produce at a rate of 100,000 bpd (Lee Nunn, 1985, ARCO, Anchorage, August, oral commun.).

Production in State Waters

Until hydrocarbons begin to flow from the Endicott field in the Beaufort Sea, all of the State of Alaska's offshore production will continue to come from the Cook Inlet. In the State waters of the Cook Inlet, 14 platforms produce oil and gas from 5 fields. Production statistics for 1984 and 1985 from these five fields are shown in table 12. The locations of the fields and platforms are shown on figure 23.

TABLE 12.—State of Alaska offshore production statistics, Cook Inlet

(Oil and natural gas liquids in barrels;
casinghead gas and dry gas in thousand cubic feet.)

	1983	1984	Cumulative (1966-1984)
Granite Point Field			
Oil	3,349,839	3,286,962	97,830,228
Casinghead gas	2,377,373	2,339,710	83,296,130
Natural gas liquids	—	—	—
Dry gas	—	—	—
McArthur River Field			
Oil	13,564,142	11,707,380	498,918,760
Casinghead gas	5,319,337	5,833,325	182,112,100
Natural gas liquids	332,030	316,804	8,198,167
Dry gas	7,931,313	9,242,309	157,893,487
Middle Ground Shoal Field			
Oil	3,381,323	3,237,713	143,956,235
Casinghead gas	2,368,353	2,210,104	72,129,373
Natural gas liquids	—	—	—
Dry gas	239,146	514,415	982,380
North Cook Inlet			
Oil	—	—	—
Casinghead gas	—	—	—
Natural gas liquids	—	—	—
Dry gas	47,877,215	46,980,877	687,731,282
Trading Bay Field			
Oil	1,083,703	1,077,262	86,036,636
Casinghead gas	892,993	961,350	57,738,919
Natural gas liquids	3,836	4,900	352,378
Dry gas	631,074	625,903	1,963,433

SOURCE: Alaska Oil and Gas Conservation Commission, 1985.

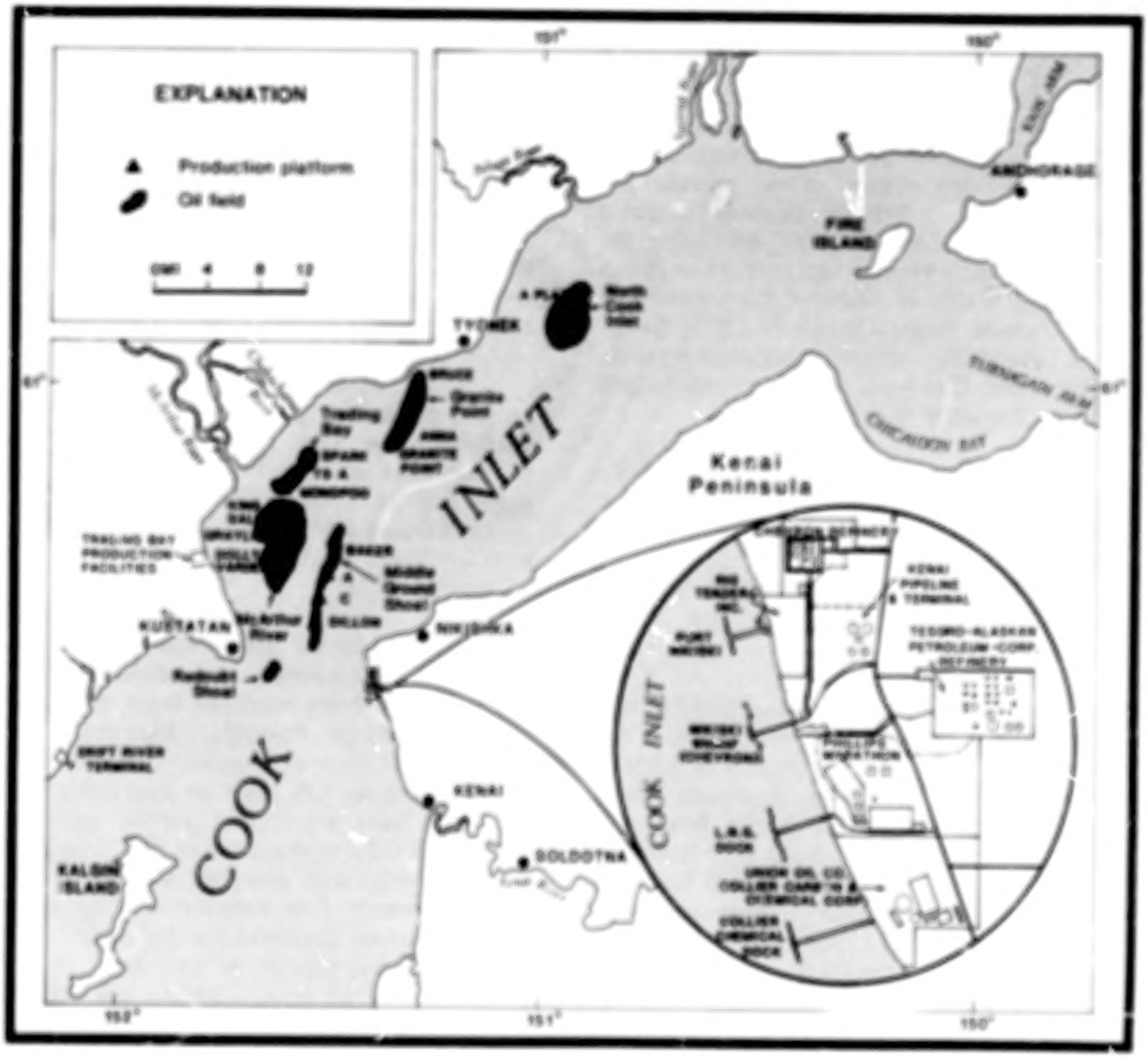

FIGURE 23.--Cook Inlet oil and gas fields and production platforms in Alaska State waters, with inset of Nikiski onshore support facilities (Alaska Oil and Gas Conservation Commission, 1985).

SUMMARY

The DOI began conducting lease sales in the Alaska OCS Region in 1976. Since that time, 10 sales and 2 reoffering sales have been conducted, resulting in the awarding of leases in 6 of the Alaska Region's 15 OCS planning areas. Under the 5-year oil and gas leasing program of July 1982, seven additional sales are scheduled and two other sales are on hold pending further assessment of industry interest. The new 5-year leasing program for the period from mid-1986 through mid-1991, currently being prepared, should continue to open new areas of Alaska's OCS frontier to leasing.

Offshore operators remain active in exploring the highly prospective submerged lands of the Beaufort Sea and Navarin Basin Planning Areas, even though harsh environmental conditions and logistical challenges make exploratory work difficult and expensive. In the Arctic, industry operators venturing farther offshore are employing innovative technologies to explore in waters where gravel islands are not practical. Mobile drilling systems suited for the Beaufort Sea are being increasingly accepted; examples of systems in use currently or planned for near-term work include Global Marine's CIDS, Beaudril's conically shaped semisubmersible **Kulluk**, and Canmar's concrete-reinforced drillship **Explorer II** and SSDC.

Recently completed exploratory work in the Norton Basin, St. George Basin, and Cook Inlet Planning Areas has led to no announced commercial discoveries of hydrocarbons. Plans for further work in these areas, in the near future, are uncertain.

Proposals for developing the first discovery to include reserves under the Alaska OCS are awaiting results of further delineation drilling from Amerada Hess' Northstar gravel island. This first discovery, made by SWEPI from Seal Island in Alaska State waters off the North Slope, is believed to hold reserves of approximately 300 billion barrels of oil, 12 to 15 percent of which underlies the OCS.

Oil and gas development activities also continue at a strong pace in Alaska State waters. The State has recently conducted two successful offshore lease sales, one in the Beaufort Sea, the other in the Cook Inlet. Under Alaska's 5-year leasing program, six future offshore sales are scheduled: four in the Arctic, one in the Bering Sea, and the other in the Cook Inlet.

Exploration of Alaskan waters is focused on the Beaufort Sea. As the State's submerged lands are closer to shore and generally in shallower waters than those of the OCS, gravel islands remain the choice of operators there for drilling platforms offshore.

Final approval of Sohio's Endicott project plans was granted in January 1985. Endicott, the first offshore oil and gas development in the Arctic, should begin producing in 1988. Construction of the gravel islands and causeways for the project in State waters was completed by November 1985.

Approvals for the Lisburne development's gravel causeway and island in Prudhoe Bay have been received from the State and North Slope Borough. However, the U.S. Army Corps of Engineers has decided to complete an EIS prior to approving the project's final significant permit application. ARCO, operator for the Lisburne development, will proceed with work on the reservoir's five onshore drilling sites while awaiting approval for the sixth site, which will be placed in the bay. First production flows from Lisburne are expected in late 1986 or early 1987.

In the Cook Inlet, production of oil and gas from five fields in State waters continues.

3. Oil and Gas Transportation Strategies

When the OCS oil and gas leasing program was first getting started in Alaska during the 1970's, transportation strategies and issues were studied carefully to assess the impacts of various scenarios. From these studies and discussions came proposals for the transportation of Alaska OCS oil and gas from offshore wellheads to shore-side transshipment facilities and from those facilities to major refineries and markets.

Since there has not yet been a commercial discovery of hydrocarbons that would lead to development and production on Alaska OCS lands, more specific studies on transportation of oil and gas have not been required. Thus the level of effort devoted to planning OCS oil and gas transportation strategies has decreased in recent years. At the same time, however, a number of events have occurred recently that are expected to influence future OCS hydrocarbon transportation proposals.

This chapter will review the recent activities of significance related to OCS transportation strategies in the Alaska Region, including

- final approval of the Endicott Development Project in State waters of the Alaskan Arctic;
- proposals for a trans-Alaska gas system shipping natural gas resources from Alaska's Arctic to Asian nations;
- a ruling to allow supertankers built with U.S. subsidies for foreign trade to pay back those subsidies and engage in carrying oil from Alaska to U.S. refineries; and
- 1984 utilization rates for the Alyeska oil pipeline from Prudhoe Bay to Valdez.

This chapter also discusses the likely scenarios for transporting hydrocarbons to refineries and markets from OCS planning areas where there has been recent exploratory drilling.

RECENT ACTIVITY

Endicott Approval

Sohio's Endicott Development Project in State waters will provide the first flow of oil from offshore in the U.S. Arctic. Since this is the first offshore development project and the economics of its development are marginal, the permitting process has been controversial and the subject of tremendous attention from Federal, State, and local authorities, as well as from industry and numerous other special interest groups. Transportation issues were among those of the greatest concern. The Endicott project is briefly discussed in chapter 2.

For a number of reasons, conventional methods used to transport hydrocarbons from offshore production platforms to land throughout the rest of the Nation will not work in the Beaufort Sea. Among the most difficult challenges to overcome are those posed by the Arctic permafrost and the movements of large ice formations.

Permafrost--the continuously frozen layer of soil, subsoil, and other deposits near the surface of most Arctic lands--extends beyond the shoreline and underlies the Beaufort Sea in varying depths to as yet undetermined distances offshore.

Pipelines cannot simply be laid on the seafloor as they are in more temperate regions of the Nation because the oil produced from thousands of feet below the seafloor, being warmer than the permafrost layer, would thaw the permafrost, in turn affecting the foundation-support properties of the base underlying the pipeline. Vast surface ice formations also present serious problems in the Arctic Ocean, as their movement annually scours and gouges the seafloor. Pipelines would be quickly torn apart if unprotected.

The FEIS for the Endicott project, published by the U.S. Army Corps of Engineers in August 1984, outlined five major development alternatives. These alternatives represent the various feasible options for transporting oil from platforms to shore in Arctic waters.

The five alternatives assessed in the Endicott FEIS were

- **Solid-fill gravel causeways.** This was the original proposal selected by Sohio, operator of the Endicott project. The plan included building two gravel islands with a 3.1-mile, solid-fill gravel causeway between the islands that would carry vehicles and support pipelines and cables. Another 1.9-mile, solid-fill causeway--also involving pipelines and cables and allowing for year-round vehicular access--would be constructed from the interisland causeway to the Sag Delta. A 1.5-mile gravel causeway approach would be built to cross the Sag Delta and connect with a gravel access road and pipeline leading to connection points with sales transportation systems such as the trans-Alaska pipeline or any future gas pipelines. Sohio's preliminary construction cost estimates for this alternative totaled $2 billion, and operation and maintenance costs were anticipated to equal $100 million per year in 1984 dollars during the 25-year projected life of the project. The locations of these causeways and islands are shown in figure 22, p. 58.

- **Breached causeways.** This plan was identical to Sohio's proposal with the exception that breaches would be built in the causeway running north-south from the interisland causeway to the Sag Delta. These breaches would allow passage of water and marine organisms. Connecting bridges would be constructed over them to carry pipelines, cables, and vehicles. Sohio estimated that a single breach 50 feet wide at the water line would add $10 million to $15 million in construction costs and $1 million to $2 million in operation and maintenance costs per year to the totals for its proposal.

- **Pile-supported causeway.** The design of this alternative would be the same as Sohio's plan except the causeway from Sag Delta to the interisland causeway would be constructed as an 8,200-foot bridge supported by steel pilings. Sohio has stated that this design, with its requisite engineering delays and high costs, would not prove economically feasible at this time.

- **Marine delta pipeline.** The route followed in this design would generally parallel the route designated in Sohio's proposal. Pipelines and cables, however, would be buried in a subsea trench dredged in the Arctic seafloor and Sag Delta, and no causeway to shore would be built. The trench would be deep enough to avoid the scouring and gouging caused by sea ice, and pipelines and cables would be thoroughly insulated to protect against permafrost melting. A minimum 1-year delay would be associated with this design, and Sohio has stated the project would not be initiated using this plan. Compared to Sohio's proposal, the costs of this fourth alternative are estimated to be $25 million to $75 million greater for construction and $5 million to $20 million greater annually for operation and maintenance.

- **West Dock pipeline.** This fifth design alternative, whose route differs significantly from the other proposals, was judged in the FEIS to be environmentally preferred. Pipelines and cables would be placed in subsea trenches, as in the marine delta pipeline alternative. Rather than run to the Sag Delta and on to shore, however, the route would extend from the main production island to the West Dock causeway in Prudhoe Bay. This route would require a much longer subsea trench than the other alternatives and would add approximately $45 million to $95 million in construction costs to Sohio's design, as well as additional costs of $5 million to $20 million annually for operation and maintenance. A delay of at least 1 year would be necessary, and Sohio has stated that this alternative would not prove economically feasible (U.S. Army Corps of Engineers, 1984).

Numerous concerns were raised regarding the impacts of solid-fill gravel causeways on the ecosystem of the Sag River Delta. With the changes in water flow associated with the causeway, alterations in normative salinity, temperature, and sedimentation rates were foreseen. The permits finally approved by the North Slope Borough, the State, and the U.S. Army Corps of Engineers required the installation of two breaches in the north-south causeway--one near shore, 500 feet wide, and the other closer to the inter-island causeway, 200 feet wide--to lessen the possible impacts on water flows offshore. A thorough and ongoing monitoring program of environmental effects was also included as a requirement.

Approval of the Endicott causeways cannot, however, be seen as a precedent for other offshore development projects in the Beaufort. While the district engineer for the Alaska Regional Office of the Corps did approve the Endicott project, at the same time he made clear in a public statement his concerns over the cumulative environmental effects of causeways built off the North Slope. The engineer stated that, in the future, applicants requesting permits for causeways would have to prove to the Corps that a subsea pipeline would not be feasible in the instant case (Alaska Construction and Oil, 1985a).

An additional factor in considering possible scenarios for an Arctic OCS development is the stipulation attached to Beaufort Sea leases regarding transportation of hydrocarbons. This stipulation (quoted in the sidebar) requires the use of pipelines to shore if at all possible from an engineering and permitting standpoint and if no net social loss is foreseen. This requirement, as well as the location of OCS leases farther from shore, led to the conclusion that only a discovery significantly larger than Endicott would be economical to develop, at least for the first, pioneering development on the Arctic OCS.

Trans-Alaska Gas System (TAGS)

In September 1983, the Yukon Pacific Corporation of Anchorage proposed building a trans-Alaska pipeline system to carry natural gas from the North Slope to an

Transportation of Hydrocarbon Products Stipulation

The following stipulation stating the Federal Government's preference for pipeline transportation of hydrocarbons from OCS wellhead to shore has been attached to leases in the Beaufort Sea, Norton Basin, St. George Basin, Cook Inlet, and Gulf of Alaska Planning Areas. It does not apply to leases in the Navarin Basin. The stipulation reads as follows:

> Pipelines will be required: (a) if pipeline rights-of-way can be determined and obtained; (b) if laying such pipelines is technologically feasible and environmentally preferable; and (c) if, in the opinion of the lessor, pipelines can be laid without net social loss, taking into account any incremental costs of pipelines over alternative methods of transportation and any incremental benefits in the form of increased environmental protection of reduced multiple use conflicts. The lessor specifically reserves the right to require that any pipeline used for transporting production to shore be placed in certain designated management areas. In selecting the means of transportation, consideration will be given to any recommendation of the Regional Technical Working Group for assessment and management of transportation of OCS oil and gas with participation of Federal, State, and local governments and the industry.
>
> All pipelines, including both flow lines and gathering lines for oil and gas, shall be designed and constructed to provide for adequate protection from water currents, storms, and ice scouring, permafrost, subfreezing conditions, and other hazards as determined on a case-by-case basis.
>
> Following the development of sufficient pipeline capacity, no crude oil production will be transported by surface vessel from offshore production sites, except in the case of emergency. Determinations as to emergency conditions and appropriate responses to these conditions will be made by the Regional Supervisor, Field Operations.
>
> Where the three criteria set forth in the first sentence of this stipulation are not met and surface transportation must be employed, all vessels used for carrying hydrocarbons to shore from the leased area will conform with all standards established for such vessels, pursuant to the Ports and Waterways Safety Act of 1972 as amended (33 U.S.C. 1221 et seq.)(49 FR 29734).

ice-free port along Alaska's southern coast. Four port locations have been mentioned by Yukon Pacific: Point Gravina, Nikiski, Valdez, and Drift River. At this transshipment facility, the gas would be processed, liquefied, and shipped to markets in Pacific rim countries, including Japan, Korea, and Taiwan. The liquefied natural gas (LNG) also could be shipped to west coast locations in the United States if domestic markets developed.

The TAGS plan is very similar to one recommended by the Alaska Governor's Economic Committee in its January 1983 report "Trans-Alaska Gas System: Economics of an Alternative for North Slope Natural Gas." Two former Alaska Governors were members of the Economic Committee and were involved in founding the Yukon Pacific Corporation: Walter J. Hickel and William A. Egan (deceased). Former Governor Hickel, who also served as Secretary of the Interior under former President Richard Nixon, has been, and remains, the most vocal proponent of the project.

As proposed, TAGS would run 820 miles. A 48-inch pipeline would stretch from the North Slope to Fairbanks, and a 32-inch pipeline would connect Fairbanks and the south coast port location. For the project to be profitable, an estimated 3 billion cubic feet of gas per day would have to be transported.

In Fairbanks, the 48-inch TAGS pipeline would connect with the proposed Alaska Natural Gas Transportation System (ANGTS). While at least 3 billion cubic feet of gas would be transported to the south coast each day in the TAGS pipeline, some of the gas brought from the North Slope would be diverted into the ANGTS line and carried across northwest Canada to markets in the United States. Although the TAGS proposal was developed as an alternative to the ANGTS project, the directors of Yukon Pacific contend that both systems could be built profitably. They maintain that the 48-inch pipeline to Fairbanks could accommodate both systems.

The ANGTS proposal, though supported by the Federal Government and most of the companies with reserves of natural gas on the North Slope, is currently on hold, and there is little indication that the project will move ahead soon. In the United States, large supplies of natural gas are available at prices lower than what it would cost to ship gas from the North Slope in the ANGTS pipeline. The cost of constructing ANGTS is generally estimated at over $40 billion, and while gas is plentiful from other supplies, no investors are expected to step forward and fund the construction.

With or without a connection to ANGTS, Yukon Pacific is moving ahead with TAGS plans. During the summer of 1985, the company initiated a $3.8 million study with ARCO and Japan's Institute of Energy Economics. This study grew out of a joint statement issued in November 1983 by President Reagan and Japanese Prime Minister Nakasone endorsing the concept of a private prefeasibility study on the development of Alaskan natural gas.

ARCO and Yukon Pacific have contracted with Bechtel Petroleum for engineering studies and capital cost estimates for the U.S. portion of the project. The American study covers estimates for an 800-mile pipeline across Alaska, a conditioning plant at Prudhoe Bay, and liquefication and port facilities on the State's south coast. The Japanese side of the study will consider shipping, regasification, and distribution costs in Japan, as well as projections for post-1990 Japanese LNG demand. The study is expected to be completed by the end of 1986.

In February 1985, Yukon Pacific and ARCO entered an agreement for a second study, this one to be pursued with Korea. The Korean study allows for a wider market perspective on demands for natural gas in Asia and also may be the first step toward Korean involvement in financing the project. The Korean companies participating in the study, which is to be completed in mid-1986, include Daewoo, Hyundai, Korea Explosives, Kukje, Lucky-Goldstar, Samsun, and Samgyong (Oil and Gas Journal, 1985d).

While construction on TAGS is still well in the future, the project could have far-reaching effects on Alaska and the United States. It would allow for production of the vast reserves of natural gas currently reinjected on the North Slope and any future discoveries of significant reserves on the Arctic OCS, alter the balance of trade between the United States and Asian nations, especially Japan, and create in Alaska another boom much like the one experienced with construction of the Alyeska oil pipeline.

Oil Tanker Regulation in Alaska Trade

On May 7, 1985, the Secretary of Transportation issued a rule allowing tankers built with U.S. subsidies for foreign trade to engage in U.S. domestic trade upon repayment of their subsidies. The Maritime Administration estimated that seven very large crude carriers (VLCC) would repay their construction subsidies and engage in trade carrying North Slope oil from Valdez to ports in the continental United States. Before the ruling, six of these VLCC's were operating in the Alaska trade under a series of 6-month permissions. The seventh VLCC had been carrying oil for the Strategic Petroleum Reserve but was laid up (50 FR 19170-19178).

Under Titles V and VI of the Merchant Marine Act (46 U.S.C. 1151 et seq.), ships built in the United States, manned by U.S. citizens, operating in accordance with U.S. safety standards, and engaging in foreign trade are eligible for construction and operating differential subsidies. These subsidies cover the higher costs of building and operating American ships relative to foreign nations, so that U.S. ships can compete internationally for trade. Ships receiving such subsidies are barred from carrying cargo between U.S. ports, as domestic trade is reserved under the Jones Act for American ships that were built and operate with no government funding.

As a result of a worldwide oversupply of VLCC's and declining levels of international trade in oil, operators of the subsidized tankers in foreign trade were eager to enter the lucrative Alaskan trade. Operators of ships already engaging in the Alaskan trade argued against the Secretary's ruling, believing that it would lead to an oversupply of vessels in the domestic trade and force many of their smaller, less efficient vessels out of work. Maritime labor unions also lobbied heavily against the ruling, arguing that it would force up to 800 mariners out of work.

In justifying her decision, Transportation Secretary Elizabeth Dole cited

- economic efficiency;
- the use of underemployed resources;
- increased competition;
- lessening of obstacles to marketplace decisions by vessel operators;
- decreased risks of oil spills; and
- increased Federal revenues.

Alaska State officials also estimate the ruling will result in increased revenues to the State of up to $100 million annually as shipping costs are decreased. Decreased shipping costs and the availability of modern, American VLCC's may be factors in future decisions regarding transportation strategies for Alaska OCS oil.

Alyeska Pipeline Utilization

The Alyeska pipeline (formerly referred to as the trans-Alaska pipeline) carries crude oil from the Arctic's North Slope to Valdez, on the Gulf of Alaska, where the oil is loaded onto tankers for shipment to refineries in the conterminous United States. It is operated by the Alyeska Pipeline Service Company, a consortium of eight major oil companies. During 1984, the pipeline carried just less than 609 million barrels of oil south from Prudhoe Bay, an increase of 8 million barrels from 1983. At the 1984 rate, approximately 51 million barrels of oil were loaded into an average of 71.5 tankers per month at the Valdez terminal (Alaska Oil and Gas Conservation Commission, 1985). It is expected that the flow through the Alyeska pipeline will continue at a similarly high rate through 1986 or 1987, given current, proven North Slope hydrocarbon reserves. After this point, flow rates will decline unless additional vast reserves of oil are discovered and developed in the U.S. Arctic.

The operation and history of the oil pipeline has been discussed extensively in previous Arctic Summary Reports, as the pipeline is the only means at present for transporting North Slope oil to major domestic markets. Refer to previous Arctic Summary Reports for a thorough history of the pipeline.

ALASKA OCS OIL AND GAS TRANSPORTATION SCENARIOS

The various scenarios for transporting OCS hydrocarbons from offshore Alaska to continental U.S. locations have been discussed in greater detail in previous Alaska OCS subregional summary reports. This section summarizes those discussions, recognizing that while much work has been done in completing general plans for each planning area where drilling has occurred, only significant discoveries on the OCS will lead to more specific proposals.

Table 13 provides an overview of the various Alaska OCS oil and gas transportation strategies. In each case, hydrocarbons are transported to a transshipment facility on an Aleutian Island, the southern coast of the Alaska Peninsula, or along the shore of the Gulf of Alaska. From this facility in an ice-free port, oil would be loaded onto VLCC's or other large tankers for shipment to continental U.S. refineries and marketing centers. The operation would be similar in this stage to the Alyeska transshipment facility activities in Valdez--loading oil from the trans-Alaska

TABLE 13.—Transportation scenarios for produced hydrocarbons from Alaska OCS planning areas

Planning area	Transportation scenario
Beaufort Sea	Subsea marine pipelines to landfall, onshore pipeline to connection with Alyeska Pipeline or natural gas pipeline system for transport to transhipment facility on coast of the Gulf of Alaska.
Norton Basin	Subsea marine pipeline to onshore storage and loading facility, icebreaking shuttle tankers to transhipment facility on south side of the Alaska Peninsula or an Aleutian Island.
St. George Basin	Marine pipeline to an onshore transhipment facility on one of the Pribilof Islands (for production sites in northern sector of basin).
	Marine pipeline to landfall, onshore pipeline to transhipment facility on south side of an Aleutian Island.
Navarin Basin	Marine pipeline to adjacent offshore loading facility, icebreaking shuttle tankers to transhipment facility on a Pribilof or Aleutian Island.
Cook Inlet	Marine pipeline to onshore transhipment facility on coast of the Cook Inlet or Gulf of Alaska.
Gulf of Alaska	Marine pipeline to onshore transhipment facility on coast of the Gulf of Alaska.

pipeline onto U.S. tankers headed for the conterminous States.

In all the scenarios except the one for Navarin Basin hydrocarbons, pipelines from offshore production platforms to onshore facilities are considered the preferred method for transportation to shore. The Federal Government has made this clear in stipulations attached to OCS leases in the Beaufort Sea, Norton Basin, St. George Basin, Cook Inlet, and Gulf of Alaska Planning Areas (see sidebar, p. 66). In general, State and local authorities also prefer pipelines, as this transportation method minimizes the risks of nearshore oil spills.

The distance of the Navarin Basin from any landfalls precludes the economic use of pipelines to shore. In a Navarin Basin production scenario, however, wellheads and transshipment facilities to tankers would be so distant from onshore locations that risks to coastal zone environments would be minimized.

SUMMARY

There have been numerous recent actions affecting future OCS oil and gas transportation strategies. Final approvals for the Endicott Development Project in State waters--the first offshore development in the Arctic--required the placement of two breaches, with a total combined width of 700 feet, in the causeway stretching north from shore. In its EIS for the project, the U.S. Army Corps of Engineers considered five alternative development plans, each including a different method for transporting oil to shore. Concerns related to causeway construction in the Beaufort Sea centered on the effects of altered water flows on salinity, temperature, sedimentation rates, and the ensuing impacts on the ecosystem. Concerns regarding the cumulative impacts of other causeways have led the Corps of Engineers to state that it would be difficult to gain future approvals for additional similar causeways off the North Slope.

Study of plans for TAGS continues. The Yukon Pacific Corporation, which originally put forth the proposal, has entered into agreements with ARCO, the Japanese Institute of Energy Economics, and a number of Korean firms to develop cost estimates for the system, shipment to Asian nations, and distribution within those countries. The Asian participants will also be assessing the post-1990's Asian market for natural gas. The reports are due in mid- to late 1986.

In May 1985, the U.S. Secretary of Transportation ruled to allow tankers, built with Federal construction subsidies for foreign trade, to pay back those subsidies and engage in transporting oil from Alaska to continental U.S. refineries. The tankers built for worldwide shipping are generally larger and more efficient than the vessels currently in the Alaska trade. The Secretary's ruling, it is believed, will result in increased competition, significantly lower shipping costs, higher Federal and State revenues, numerous smaller ships being driven out of Alaska trade, and the loss of hundreds of merchant seaman's jobs.

During 1984, the Alyeska pipeline transported just less than 609 million barrels of oil from Prudhoe Bay to Valdez. It is expected that similarly high rates of flow will continue through 1986 or 1987, when declines will begin unless other vast resources of oil are discovered.

Scenarios for the future transport of hydrocarbons from the OCS generally focus on pipelines from OCS production platforms to onshore transshipment facilities, where hydrocarbons will be loaded onto U.S. tankers for shipment to refineries in the continental United States. This preference has been attached through MMS lease sale stipulations to all Alaska OCS leases except in the Navarin Basin. In the Navarin Basin, the scenario would be significantly different, as a result of that planning area's great distance from shore. In the Navarin, pipelines would run from production platforms to offshore tanker-loading facilities. The hydrocarbons would then be shipped to continental U.S. refineries.

4. Nature and Location of Onshore Support Facilities

Support facilities for OCS work consist of a wide range of coastally based operations that provide service, supply, and port capabilities to accommodate day-to-day needs as well as long-term activities of the offshore oil and gas industry. Service bases may be temporary or permanent, large or small, unifunctional or multipurpose. The selection of support bases to provide the entire range of services and supplies is important logistically for conducting all facets of offshore operations. They provide the operations link between the offshore facilities and the coastal infrastructure.

The relative scale and pace of offshore operations are directly related to the extent of the offshore support infrastructure in a particular area. For instance, OCS activity in Alaska has been limited to exploration work; at this stage in the offshore oil and gas development process, few onshore support facilities specifically related to offshore activity are required.

Towns and villages in each of the Alaska OCS subregions have experienced some impact from offshore activity, but often on short-term bases or at minimal levels. Warehouses, docks, and airfields have been employed by offshore operators, but the facilities were generally in place and originally built for other purposes related to fishing, onshore oil production, or other industrial projects. The following subregion overviews and table 14 summarize the nature and location of onshore support facilities for Alaska OCS activities.

ARCTIC SUBREGION SUPPORT FACILITIES

Beaufort Sea Planning Area

The Prudhoe Bay/Deadhorse industrial complex on the North Slope has served as the support base for Beaufort Sea exploration. The airfield and warehousing facilities used were all previously in place as part of the Prudhoe Bay onshore oil production operation. See table 14 for a listing of support facilities in the Arctic Subregion.

The Prudhoe Bay field is located 250 miles north of the Arctic Circle on the edge of the Beaufort Sea. Following the discovery of the field in 1968, the development has grown to encompass approximately 200 square miles of the 400-square-mile field. Nearly 5,000 people are employed in Prudhoe Bay area development (Sohio, 1984). Almost all these people are flown in and out of the Arctic to work their 12-hour-per-day, 7-day-per-week shifts in the fields; few remain in the area be-tween shifts as full-time residents.

Two operators manage the Prudhoe Bay Unit: ARCO operates the eastern half and Sohio operates the western half. Each operator maintains its own operations center. Several service roads intersect the main 30-foot-wide by 5-foot-thick access road; together these roads run approximately 200 miles. Sohio operates the central power station, located in the western half of the unit. A number of small generators are used by contractors to produce additional power. The central station, powered by seven turbine generators fueled by natural gas, provides electricity to all field facilities. This station can generate 160 megawatts, or enough electricity to power a city with a population of approximately 80,000.

Besides the two main operation centers, each company maintains three oil-gas separation plants strategically located within the field. Drilling pads that contain producing wells are grouped in several locations around these separation plants. Each of the six separation plants are

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TABLE 14.—Actual or potential OCS support facilities in Alaska

Name	Type of service/ support	Planning area serviced	Description of facility
Deadhorse Airport ARCO Airport	Airport	Arctic Sub-region planning areas	6,500-ft paved airstrip, 5,500-ft gravel airstrip
West Dock East Dock Prudhoe Bay	Port	Arctic Sub-region planning areas	Limited harbor facilities available late July to early September for use during approximately 6-week ice-free season for sea lifts. West Dock—1.5-mile gravel causeway; East Dock—shallow water dock onshore
Oliktok Point Kuparuk	Port	Arctic Sub-region planning areas	Limited harbor facilities
Dutch Harbor	Port	Bering Sea Sub-region planning areas	Ice-free, deepwater, natural anchorage
Unalaska City Airport	Airport	Bering Sea Sub-region planning areas	4,000-ft airport being extended by 2,000 ft
Cold Bay Airport	Airport	Bering Sea Sub-region planning areas	2 paved runways—5,162 ft and 10,415 ft
Nome Harbor	Port	Bering Sea Sub-region planning areas	Plans for a 3,600-ft gravel causeway dock with 27-ft draft capabilities; existing lighterage operations only
Nome Airport	Airport	Bering Sea Sub-region planning areas	6,039-ft paved airstrip 5,610-ft paved airstrip
Nome City Airport	Airport	Bering Sea Sub-region planning areas	3,200-ft gravel airstrip
St. Paul Island Airport	Airport	Bering Sea Sub-region planning areas	5,175-ft gravel airstrip
Unalakleet	Airport	Bering Sea Sub-region planning areas	6,567-ft gravel airstrip
Moses Point	Airport	Bering Sea Sub-region planning areas	4,633-ft gravel airstrip

TABLE 14.—Actual or potential OCS support facilities in Alaska—Continued

Name	Type of service/ support	Planning area serviced	Description of facility
Gambell on St. Lawrence Island	Airport	Bering Sea Subregion planning areas	4,521-ft gravel airstrip
Yakutat Airport	Airport	Gulf of Alaska Subregion	3,600 acres, with two helicopter hangar facilities
Yakutat/Monti Bay Harbor	Port	Gulf of Alaska Subregion	115-ft pier for workboats, deepwater
Kenai Harbor	Port	Gulf of Alaska Subregion	Rig tenders deepwater dock at Nikiski (10 miles north of Kenai)
Homer Harbor	Port	Gulf of Alaska Subregion	City-owned deepwater dock on Homer spit
Homer Airport	Airport	Gulf of Alaska Subregion	7,400-ft paved airstrip
Kodiak Harbor	Port	Gulf of Alaska Subregion	Channel: minimum 22-ft MLLW* depth, 200-ft width; breakwaters: 1,290 and 760 ft long
Port Lions/ Kodiak Airport	Airport	Gulf of Alaska Subregion	2,600-ft gravel airstrip adjacent to U.S. Coast Guard base airfield
Seward Airport	Airport	Gulf of Alaska Subregion	4,600-ft paved airstrip
Seward Harbor	Port	Gulf of Alaska Subregion	Channel: minimum 13-ft MLLW* depth, 120-ft width; breakwaters: 2 rock mounds 1,060 and 1,730 ft long, with provision for further basin expansion

*MLLW = Mean lower low water, which is the lower of two low tides of unequal height occurring each tidal period of 24 hours, 40 minutes.

capable of processing 300,000 bpd. This capability has allowed the two operators to maintain an average production rate of 1.5-million-bpd since 1979. The Prudhoe Bay Unit produced its 4 billionth barrel of oil on May 30, 1985 (Sohio, 1985).

A small field refinery known as the crude oil topping plant has been in operation in the Prudhoe Bay field since October 1969. It produces naphtha, diesel fuel, and jet fuel for local consumption. Approximately 22,000 bpd of crude oil are refined with resulting end products averaging about 4,200 bpd; the surplus is returned to the oil transit system. The majority of the product is Arctic diesel fuel.

Arctic conditions produce a unique situation that minimizes the demand for dock support of offshore activities. Ice roads may be constructed during winter months to those offshore drilling sites that are close enough to shore to warrant the procedure. These roads supply the sites with necessary equipment, materials, and personnel until spring breakup, at which time barges must once again be used. Amoco is scheduled to begin construction of an ice island and related support facilities in the Beaufort Sea for a February 1986 spud date. The 450-foot-diameter island will be in 26 feet of water, located about 97 miles northwest of Prudhoe Bay (Ocean Construction Report, 1985b).

ANNUAL ARCTIC SEALIFT. Much of the infrastructure in place at the North Slope and most of the development occurring now consists of modular components fabricated in the continental United States that are towed to the docks at Prudhoe Bay on barges in an operation known as the annual Arctic sealift. Timing is crucial, because there is typically just a 6-week period when sea-ice conditions allow such an operation to occur. Complex logistical support is needed to determine the precise time the sealift leaves port (which was Seattle in 1985) and follows through to the docking operation at the North Slope. Assembly and loading of modules for the 1986 sealift will occur at Seattle, Tacoma, and Anacortes, Washington, as well as Portland, Astoria, and Tongue Point, Oregon (Alaska Oil and Gas News, 1986).

Lisburne Development. Underlying part of the Prudhoe Bay oil field and continuing to the east is the Lisburne field, which is currently being developed by ARCO. A total of 180 wells are scheduled to be drilled from 6 drill sites (ARCO, 1984). Modular oil and gas handling facilities are being fabricated now in Oregon at the Portland Ship Repair Yard and at the Astoria Oil Services Yard. The modules are expected to arrive at Prudhoe Bay on the anticipated record-sized 1986 Arctic sealift.

Field startup is scheduled for late 1986 or early 1987 at an initial production rate of 40,000 bpd, increasing to 100,000 bpd in 1988 (Dana Grannell, 1985, ARCO Alaska, Anchorage, August, oral commun.). A five-well, 160-acre pilot waterflood project also is planned as part of the initial Lisburne development plan.

The fact that the U.S. Army Corps of Engineers is requiring an EIS for the construction of the Lisburne causeway will not significantly delay field development plans because drilling from the offshore sections of the field is not scheduled to occur until 1988 or 1989 (Lee Nunn, 1985, ARCO Alaska, Anchorage, August, oral commun.).

Kuparuk Development. The Kuparuk field is currently the most active field in the United States, with more than 800 construction workers presently employed (Alaska Journal of Commerce and Pacific Rim Reporter, 1985). A $150 million, field-wide waterflood program started as a pilot project in 1983 is responsible for much of this activity. About $92 million of that amount was spent on a seawater treatment plant that arrived with the 1985 Arctic sealift. The plant is scheduled to begin operation in November 1985. Although expansion of development drilling will initially increase the production capacity of the field, a number of those wells will have to be used as injection sites for the waterflood project, thus actually decreasing the field's daily production capability. The purpose of the project is to expand the productive life of the field over the long term, because unlike the Prudhoe Bay field, Kuparuk has no gas cap to provide natural lift. Central Production Facility No. 3 for the Kuparuk field will be fabricated at the ARCO site in Anacortes, Washington, where about 700 workers will be employed on the project (Pacific OCS News, 1985c). The equipment is scheduled to be part of the 1986 Arctic sealift.

Milne Point. The Milne Point Unit is operated by Conoco Inc. The unit is located north of Kuparuk and is an extension of the Kuparuk River and West Sak sands. The field barely holds enough oil to be classified as a giant in an area that generally requires several hundred million barrels of oil reserves to be considered a good economic risk. On November 2, 1985 (about 5 months ahead of schedule), the Milne Point field came on line at about 10,000 bpd. The multiphase development project for this "marginal field" calls for a full production rate of 30,000 bpd to be reached by the end of December 1985 (Anchorage Daily-News, 1985b). As a phased development, Milne Point does not require the full-fledged 60,000-bpd processing facility that would be required if the whole field came on line as a single development (Alaska Construction and Oil, 1985b). A 45,000-bpd capacity water injection system was built into the processing modules that arrived with the 1985 Arctic sealift.

Endicott Development. Sohio Alaska Petroleum's Endicott project includes building 5 miles of causeways and two production islands 2.5 miles out into the Beaufort Sea (see fig. 22, p. 58). The 1987 Arctic sealift will bring the various process and facility modules to the Endicott dock. If development plans remain on schedule, Sohio will begin pumping 100,000 bpd from this field in 1988. Although primarily an extension of onshore technology, the successful development of the Endicott field will be a significant advancement of the onshore infrastructure and may aid future offshore field development efforts.

OTHER SUPPORT FACILITIES. Camp Lonely is located on the coast of the Beaufort Sea approximately 80 miles west of Oliktok Point and the Kuparuk field (see fig. 14, p. 45). Constructed in 1976 by the Federal Government, it served as a support base for U.S. Geological Survey exploration activities in the National Petroleum Reserve - Alaska (NPRA). Competitive oil and gas leasing began in the NPRA in 1980, and Camp Lonely was subsequently found to be Federal surplus land. The General Services Administration, which is responsible for disposing of surplus lands, opened bids for the camp on November 16, 1982. The successful high bidder for Camp Lonely was the Cook Inlet Region, Inc. (CIRI), 1 of 12 regional corporations established by the Alaska Native Claims Settlement Act (ANCSA) of 1971. CIRI's high bid proposed to give the Federal Government corporate lands valued at $5.7 million in exchange for Camp Lonely assets. The land exchange bid was made possible by a 1976 agreement between CIRI, the State of Alaska, and the Federal Government that aimed to remove obstacles to the corporation's land conveyances under the ANCSA.

The 100-person camp has offices, a carpentry shop, communications shop, sewage treatment plant, generating system, vehicle maintenance shop, large tank farm, and both warm and cold storage warehouses. There is a substantial inventory of drill pipe, casing, and drilling muds. CIRI also has an agreement with the U.S. Air Force to use the Defense Early Warning (DEW) line airstrip, hangar, and tank farm that lie 0.9 mile to the east of Camp Lonely. CIRI intends to operate the camp as a joint venture with the Arctic Slope Regional Corporation (ASRC). The ASRC is negotiating a land trade with the Federal Government for several hundred acres surrounding the camp and airstrip. This land would provide room for any expansion that might be necessary.

Industry has only recently begun to probe the offshore areas to the east and west of Prudhoe Bay. Because Exxon, the only recently active operator in the western Beaufort, has been employing Global Marine's self-contained CIDS, any onshore support that is necessary will be conducted from the facilities located at Prudhoe Bay. However, if hydrocarbon discoveries are made, Camp Lonely could serve as an important support base for development activities.

Bullen Point is located 35 miles east of Prudhoe Bay and just west of the Point Thomson Unit on the shore of the Beaufort Sea (see fig. 21, p. 57). The North Slope Borough purchased this property, which had been a DEW line station. The facility contains an airstrip and a few buildings and could be used as a support facility if development occurs in the eastern Beaufort area.

Chukchi Sea and Hope Basin Planning Areas

Because MMS has never held a lease sale in either the Chukchi Sea or Hope Basin Planning Areas, no EIS's have been undertaken. Therefore, potential onshore impacts have not been identified for localities within these planning areas. The only centers of human habitation that could potentially support OCS activities are Barrow, Wainwright, Point Lay, and Point Hope. Until such time as a lease sale occurs in these areas, little consideration will be given to assessing the potential impacts of OCS development.

BERING SEA SUBREGION SUPPORT FACILITIES

In the Bering Sea Subregion, several communities have experienced some level of activity or can be expected to in the future. For a listing of current or potential OCS support facilities in the Bering Sea Subregion, see table 14, p. 72.

Norton Basin Planning Area

Nome, located on the south shore of the Seward Peninsula, is the major population center adjacent to the Norton Basin Planning Area (see fig. 5, p. 9).

Given Nome's place as the center of development in the region, it is the community that could best support future offshore exploration activity without significant investment and development by industry operators. The city is building a major new medium-draft port facility to serve resource development in northwest Alaska. The project, which began in June 1985, calls for construction of a 10-acre onshore storage facility and a rubble-mound causeway extending 3,000 feet offshore. Approximately 60 percent of the stone required for the construction has been quarried from Cape Nome and hauled the 13 miles to the project site. The causeway is currently 900 feet long and rises 11 feet above sea level. The contractor, Kiewit Pacific Company of Vancouver, Washington, is scheduled to complete the $21,315,850 project by December 1986. The most notable problems to date have been associated with the road between the Cape Nome quarry and the project site. The fragile tundra underlying the gravel roadway has failed in places under the heavy truck loads of rock. The problem is not perceived to be insurmountable, although it has led to the consideration of alternatives, including barging and even the construction of an ice road such as those used at the North Slope (Denis Campion, 1986, Port Director, City of Nome, January, oral commun.).

Specifically, the port will handle shipping related to offshore oil and gas activity, mining activity on the Seward Peninsula and in the western Brooks Range, and commercial fishing. The new port will result in marine transport savings. Lighterage services now in operation would average $77 per ton from 1985 to 2000. The new port will eliminate lighterage charges, so that the average cost per ton of cargo will be reduced to about $51, which will cover capital amortization and operation expenses (Denis Campion, 1985, Port Director, City of Nome, July, oral commun.).

The new Nome port will serve both as a storage area and as a base for supply boats carrying materials and equipment needed for offshore exploration, development, and production in Norton Basin. Currently, marine transportation in the Norton Sound area is available only during the summer. The port of Nome is located at the mouth of the Snake River and consists of a channel leading to a turning basin, a dock, and warehouse facilities. The existing port can only accommodate small lighterage vessels and barges with drafts from 3 to 5 feet and lengths up to 200 feet (Peat, Marwick, Mitchell and Co. and James Lindsay and Associates, 1980). Oceangoing vessels and barges calling at Nome anchor approximately 1 to 3 miles offshore. The cargo is transferred to lighterage vessels and carried to the port. Cargo destined for other coastal communities in the Norton Sound area is offloaded onto beaches.

The drilling of exploration wells in the Norton Basin took place during the summers of 1984 and 1985. A total of five wells were drilled, all from jack-up units. For each of the drilling units, major materials needed to supply the drilling operation were stored on a large, seagoing barge anchored near the drill site. If exploration drilling continues on a seasonal basis, supply barges will most likely be used to support the drilling operations. Personnel, routine supplies, and materials are expected to be transported to the drilling unit from Nome by boat or helicopter. Two seagoing supply vessels would service each unit and could operate out of the existing port facilities at Nome. The number of boat trips per drilling unit should generally be less than one per day. Nonroutine equipment and materials could be supplied by boat from Dutch Harbor or Kenai (see figs. 17 and 23, pp. 48, 61). The helicopters used to support the drilling units would be certified for instrument flight and would carry personnel, lightweight supplies, and equipment.

If the level of exploration and delineation well drilling increases so that several units operate year round, a small support base could be developed in the Nome area. Also, any type of unit used for year-round drilling would require extended support for personnel and equipment. This support could be handled with helicopters, icebreaking/supply boats, or possibly air-cushioned vehicles.

Navarin Basin Planning Area

For the Navarin Basin Planning Area, two other communities in the subregion are expected to handle most of the offshore oil- and gas-related activity: Cold Bay and Dutch Harbor. Located near the north side of the Alaska Peninsula, the settlement of Cold Bay is basically an air support enclave populated by Federal and State government officials and airline staffs, plus a minimal staff performing support functions (see fig. 5, p. 9). The population in 1980 was 228. Cold Bay offers the best civilian airport in the area; consequently, any OCS petroleum activities in the subregion will likely use Cold Bay as a center for air support.

Dutch Harbor on Unalaska Island is the second largest community in the Aleutian Islands Census Division and is by far the largest community likely to be affected by proposed OCS petroleum activities. The total population in 1980 was 1,322, including 598 persons living in group quarters. It is likely that the harbor facilities at Unalaska/Dutch Harbor would be used to provide marine support for planned offshore petroleum activities in the Bering Sea Subregion.

Support for the 1985 exploratory drilling activities in the Navarin Basin, in addition to Cold Bay and Dutch Harbor, has been from St. Paul, located in the Pribilof Islands. Situated about 300 miles from the Navarin Basin drilling sites, St. Paul is used as the personnel support base (see fig. 5, p. 9).

In a joint venture between Aleut Corporation (a regional Native corporation) and Arctic Host Corporation, 7 acres of land have been leased from the Tanadgusix Corporation (also a Native corporation). Exxon, Amoco, and ARCO operate the large hangars that can accommodate four or five Chinook-class helicopters. The three oil companies also operate a 115-person camp used primarily for support personnel, but also used to house rig personnel when poor weather delays or grounds crew change flights (Dennis Freeman, 1985, Aleut Corp., Anchorage, October, oral commun.). Between June and August, 1985, fog had been the major planning and logistical problem for Navarin operations (Zaremba, 1985).

For marine support, Amoco has employed the warehouse ship or "wareship" concept because the support facility at

Dutch Harbor is about 500 miles away. In this instance, several foreign-flag vessels including a 65,000-deadweight-ton (dwt) converted bulk carrier used as a wareship for handling pipe, casing, tools, and bulk barite (drilling mud) and a 47,000-dwt tanker used for diesel fuel, drill water, and potable water comprised part of the support vessel fleet (Zaremba, 1985). Amoco's use of foreign-flag vessels to support this drilling program stirred up such controversy in the offshore market that the Offshore Marine Services Association, with the assistance of several Members of Congress from coastal States, succeeded in pressuring the U.S. Customs Agency to rescind its ruling that allowed the use of foreign-flag support vessels. Amoco will be required to use U.S.-flag supply vessels next year, because Customs ruled the wareship is a coastwise point, or port within the U.S., and thus must be served by U.S.-flag supply boats, as required by section 20 of the Merchant Marine Act of 1920 (46 U.S.C. 883), also known as the Jones Act (Ocean Construction Report, 1985a).

The landfall nearest to the Navarin Basin drilling sites is St. Matthew Island, although it is still some 300 miles to the east of the most remote exploratory wells. This uninhabited, 128-square-mile island had been considered the best location for the development of an airstrip and a personnel support base (see figs. 5 and 18, pp. 9 and 49). The only area on the island suitable for oil-related development is at the extreme southeastern end, which is relatively flat and contains a small plain. This area is part of the 4,092 acres of land transferred to three Native corporations on August 10, 1983, under an exchange agreement with DOI. Also on that date, the National Audubon Society filed the first of three separate suits all concerned with the development of St. Matthew Island. The summaries below will address the litigation in turn (MMS, 1985a).

A83-425: THE EXCHANGE CASE. The suit **National Audubon Society et al. v. Donald Hodel, et al.** (Civ. No. A83-425, (D., Alaska, Nov. 30, 1984), appeal docketed, No. 85-3673, 85-3683, 85-3686, (9th Cir. March 7 and 11, 1985)) challenges the August 10, 1983, land exchange agreement signed by Deputy Under-Secretary of the Interior, William P. Horn, acting on behalf of then Secretary of the Interior James G. Watt and entered into with representatives of three Alaska Native corporations. The three corporations, CIRI, Calista Corporation, and Sea Lion Corporation, are referred to collectively as the CIRI Group.

On August 10, 1983, the National Audubon Society and other environmental groups, joined by the Bering Sea Fisherman's Association, filed a complaint for declaratory and injunctive relief in the U.S. District Court for the District of Alaska. The plaintiffs' relief requested (1) a declaration that the exchange agreement is unlawful and void and (2) an injunction preventing the defendants from carrying out the terms of the agreement and prohibiting the defendants from in any way conducting any activity on St. Matthew Island under the terms of the agreement.

The land exchange was issued under the authority of section 1302(h) of the Alaska National Interest Lands Conservation Act. The conveyance is for 50 years, or so long as commercial oil production activities occur in the Navarin Basin.

St. Matthew Island was established as a wildlife refuge in 1909 and designated a wilderness area in the National Wilderness Preservation System on October 23, 1970. In its suit, the National Audubon Society charged that the Secretary should have followed the National Environmental Policy Act (NEPA) process and adhered to the Administrative Procedures Act by soliciting public comments and that he should have obtained prior Presidential and congressional approval of his action to convey these lands. Oral arguments were heard before Judge James Fitzgerald on June 27, 1984.

A84-401: THE PERMIT CASE. The CIRI Group applied to the U.S. Army Corps of Engineers for a permit to place fill material on wetlands on St. Matthew Island to construct an airstrip and to place gravel on the island to construct three roads. The Corps of Engineers had given public notice on June 7, 1984, inviting comments on the application. The National Marine Fisheries Service and the Environmental Protection Agency (EPA) responded that an EIS was needed.

On September 18, 1984, the National Audubon Society filed a complaint, **National Audubon Society et al.** v. **Cook Inlet Region et al.** (Civ. No. A84-401, (D., Alaska, Nov. 30, 1984)), against the CIRI Group in the U.S. District Court for the District of Alaska seeking declaratory and injunctive relief.

The National Audubon Society sought an injunction prohibiting the CIRI Group from discharging any dredged or fill material on St. Matthew Island wetlands until authorization had first been obtained from the Corps of Engineers.

A84-402: THE NEPA CASE. On August 20, 1984, the CIRI Group submitted a plan of operation to Robert Putz of the U.S. Fish and Wildlife Service (FWS) for facility construction on St. Matthew Island. Mr. Putz responded in a letter dated August 30, 1984, that construction activity carried out in accordance with the plan would not result in significant damage to St. Matthew Island bird or other wildlife populations.

On September 18, 1984, the National Audubon Society filed suit against Mr. Putz and the CIRI Group in the U.S. District Court for the District of Alaska (**National Audubon Society et al.** v. **Robert Putz, Regional Director, U.S. Fish and Wildlife Service et al.** (Civ. No. A84-402, (D., Alaska, Nov. 30, 1984), appeal docketed, No. 85-3671, 85-3684, 85-3685, (9th Cir. March 7 and 11, 1985)). The immediate cause cited by the plaintiffs that led to the filing of this case was the lack of opposition by the Alaska FWS Regional Director to the CIRI Group's operational plan.

The plaintiffs claimed that the letter of nonobjection sent by Mr. Putz constituted a major Federal action, triggering EIS requirements under NEPA. They sought to enjoin the defendants from undertaking any actions on St. Matthew Island until an EIS could be prepared on the CIRI Group's proposed plan of operation.

On September 27, 1984, the plaintiffs moved for a preliminary injunction in all three cases--the exchange case, the permit case, and the NEPA case. A hearing on the preliminary injunction was held on October 22, 1984, before Judge James Fitzgerald. As a result of this hearing, Judge Fitzgerald issued a temporary restraining order against the CIRI Group, preventing them from moving equipment to St. Matthew Island until November 16, 1984. The temporary restraining order was further extended until November 23, 1984.

On November 30, 1984, Judge Fitzgerald ruled on all three cases as follows:

- The Secretary's Public Interest Determination for the St. Matthew Island exchange suffered from serious errors of judgment and misapplication of law that led to a clear error of judgment.
- The St. Matthew Island land exchange was invalid.
- In case A84-401 (the permit case), the plaintiffs' request for relief was premature, as the Corps of Engineers had not yet made a final decision on the CIRI Group's application for permit.
- The plaintiffs' application for a preliminary injunction in case

A84-402 (the NEPA case) must be granted.

In case A83-425 (the exchange case), the court granted the plaintiffs' motion for summary judgment and denied the defendant's motion for summary judgment. In case A84-401 (the permit case), the court denied the plaintiffs' motion for preliminary injunction. And in case A84-402 (the NEPA case), the court granted the plaintiffs' motion for preliminary injunction.

The $2,500 bond previously posted by the plaintiffs as a condition of the temporary restraining order remained in effect as the bond required for this preliminary injunction.

On March 1, 1985, the Federal defendants filed a notice of appeal with the Ninth Circuit Court of Appeals for cases A83-402 (the NEPA case) and A83-425 (the exchange case). On October 2, 1985, the appeals for both cases were dismissed voluntarily by the Federal defendants and all other appellants in the Ninth Circuit Court of Appeals (Dirk Snel, 1985, Department of Justice, Washington, D.C., October, oral commun.).

St. George Basin Planning Area

Support for the exploratory drilling that took place in the St. George Basin Planning Area was from Cold Bay and Dutch Harbor. Depending on the timing and extent of industry interest, St. George Island might be used to support any future activities within the planning area (see fig. 17, p. 48).

Similarly, support operations for any future OCS activity in the North Aleutian Basin Planning Area would likely be located at existing facilities such as Dutch Harbor and Cold Bay. The reasons for this are twofold: (1) The most prospective areas of potential exploration are in the south of the planning area, giving the existing facilities a geographic advantage, and (2) the large financial investment needed to initiate operation of a new facility would render mainland facilities prohibitive unless a large enough discovery was made to warrant such development.

GULF OF ALASKA SUBREGION SUPPORT FACILITIES

In the Gulf of Alaska Subregion, offshore operators may choose to work out of Dutch Harbor or Cold Bay again if exploration is taking place in the western OCS leasing areas. In the central and eastern portions of the subregion, a number of small towns and villages could and have served as exploration support bases. Homer, Kenai, Seward, and Yakutat are fishing communities with some lesser level of trade activity. Previously, during boom times in Alaska, these towns were significant ports with much higher levels of commercial trade; thus much of their capacities are underutilized today. For a listing of current or potential OCS support facilities in the Gulf of Alaska Subregion, see table 14, p. 72.

Two areas in Homer have previously supported OCS operations. The city-owned dock and airport experienced modest activity associated with exploration drilling resulting from Cook Inlet Lease Sale CI between July 1978 and June 1980. More recently, the airport was used to support air operations during the drilling of an exploratory well in the Shelikof Strait from December 1984 through March 1985. The well, operated by Chevron U.S.A., did not result in an announced commercial discovery. However, an award was given to Chevron U.S.A. by representatives of the Kodiak Island Borough for joining in partnership with the people of Kodiak to explore not only for oil, but for new forms of cooperation, coordination, and communication. The presentation of the award is significant because it recognized an industry effort that surpasses the minimal requirements of such a relationship.

Marine support for the previously mentioned well and other Lease Sale 60 exploratory efforts in the Cook Inlet Planning Area has been from the Nikiski Rig Tenders dock, located about 10 miles north of Kenai. Because Kenai is an established support base for offshore oil and gas activity in State waters, it is difficult to ascertain exactly what impacts have been caused by OCS activity. Currently, about 20 percent of the population is estimated to be involved in the oil industry in some way. The existing facilities appear to be adequate because no new building has occurred in Kenai as a result of OCS lease sales.

Two oil refineries are currently located adjacent to the Gulf of Alaska Subregion. Both Tesoro Petroleum Corporation and Chevron U.S.A. have facilities situated at the Port of Nikiski on the Kenai Peninsula. These two refineries were established to handle Cook Inlet production, which was the first major supply of crude oil to the region. However, very little oil has been found in the Cook Inlet since the initial discoveries in the mid-1960's. Accordingly, both Tesoro and Chevron have worked to obtain long-term royalty oil contracts to ensure alternative sources of crude to supplement the declining Cook Inlet supply. Tesoro currently has two contracts with the State for the purchase of about 46,000 bpd of North Slope crude (Alaska Oil and Gas News, 1985). Tesoro's recently completed $93 million expansion project will allow a new contract with the State to be implemented. That contract, for an additional 26,000 bpd of North Slope royalty crude, runs through January 1, 1995 (Alaska Oil and Gas News, 1985). Tesoro gets its North Slope crude oil via tanker from the Valdez Marine Terminal of the Alyeska pipeline.

In October 1985, proposals to stimulate competition by assembling refineries in the City of Valdez were being negotiated between the Alaska DNR and two prospective operators: Valdez Refining Company and Arctic Energy Corporation. DNR Commissioner Esther Wunnicke and some members of the State Royalty Oil and Gas Development Advisory Board believe the State might be unable to continue supplying the refineries with large amounts of oil after the long-term contracts expire (Anchorage Daily-News, 1985a). The current 200,000-bpd royalty share comes from the Prudhoe Bay and Kuparuk oil fields, which are on State land leased to oil companies.

Because Seward was not used for Lease Sale 60 activities, the port experienced its greatest OCS impacts prior to the first lease sale in the Gulf of Alaska Subregion, Lease Sale 39 in April 1976. Interest was very high and led to considerable land speculation. Land prices quadrupled just prior to the sale. Although no commercial discoveries were made, the price of land did not return to its earlier level. The other lasting impact of Lease Sale 39 on Seward is the town's increased awareness of the type of support needed for OCS activity. Seward has been searching for a way to regain a strong economy since the 1964 earthquake. If it is built, the proposed Seward marine industrial center will provide year-round stable employment and stimulate local industry. It could also serve as an outstanding support base for any future OCS activity in the Gulf of Alaska or Cook Inlet and will be able to provide repair service for rigs and supply boats.

Along with use of the port's dock and storage facilities, the Yakutat airport also has been used to support offshore exploration. The community has sought to limit and control oil industry development as a result of perceived threats to its lifestyle. At one point in the early 1970's, a consortium of offshore operators invested $3.5 million to purchase a 2.5-acre site and construct a temporary dock and storage facility in the village. At the time, this investment was three and one-half times the assessed value of all the real property in Yakutat. However, no recent OCS activity has occurred in close enough proximity to warrant the use of Yakutat as a support facility. Because Lease Sale 88 has been postponed indefinitely, the area will likely not be the scene of OCS exploration activities in the near future.

SUMMARY

Shore-based support facilities may serve both onshore and offshore oil and gas operations. OCS activity in Alaska has been limited to exploration work and has not necessitated the development of onshore support facilities specifically related to offshore activity.

Marine support for Arctic OCS activities uses less than 10 percent of available dock capacity on the North Slope. However, marine support in the form of an annual sealift of modular equipment is being used for the many development projects currently underway. These projects include ARCO's Lisburne development and Kuparuk field, Conoco's Milne Point Unit, and Sohio's Endicott development.

Camp Lonely, located about 80 miles to the west of the Kuparuk field, could see increased activity as a potential OCS support facility if development takes place in the western Beaufort Sea. Similarly, Bullen Point, located 35 miles east of Prudhoe Bay, could be the site of an OCS support base if activity increases in the eastern Beaufort Sea.

The only areas having potential as OCS support facilities in the Chukchi Sea and Hope Basin Planning Areas are the population centers at Barrow, Wainwright, Point Lay, and Point Hope.

In the Bering Sea Subregion, Nome is the support base for OCS activity in the Norton Basin Planning Area. Nome has two airports and is currently modernizing its port facility.

Marine support for Navarin Basin exploratory drilling has taken place from Dutch Harbor on Unalaska Island. Air support has been provided from St. Paul Island, in the Pribilofs, and from Cold Bay on the Alaska Peninsula. The operation on St. Paul consists only of helicopter support, primarily for personnel, while operations from the other two areas have been more typical of other OCS support operations.

Two items of controversy have arisen as a result of the Navarin Basin exploratory activity. Amoco has used foreign-flag vessels for standby support efforts, causing the U.S. Merchant Marine trade organization to fight a U.S. Customs Service ruling. In addition, the St. Matthew Island land transfer was ruled invalid as a result of a November 1984 decision, and a subsequent appeal was voluntarily dismissed by the Federal defendants.

Support for OCS activity in the St. George Basin and North Aleutian Basin Planning Areas would likely be from Dutch Harbor and Cold Bay, if development were to occur in the near future.

The ports of Homer, Kenai, Seward, and Yakutat have been and probably would be used again as support bases if OCS activity in the Gulf of Alaska Subregion increases in the near future.

Competition is increasing in the refinery market for State-owned North Slope royalty crude oil. Proposals are currently being considered for the establishment of two refineries in Valdez, the terminus of the Alyeska pipeline.

Conclusion

The Alaska OCS Region's potential is great; MMS estimates that undiscovered economically recoverable hydrocarbon resources on leased and unleased lands total 3.33 billion barrels of oil and 6.90 trillion cubic feet of gas. These energy riches are hidden beneath harsh and treacherous seas, however, and the region's potential has only begun to be tested. As government officials seek to protect the public's interests and ensure fair return for the Nation's resources and offshore industry operators work to discover and develop Alaska's subsea wealth, both groups have come to better understand the Alaskan offshore environment and the technologies required to work there. Exploration and development should proceed at an increasingly strong pace.

Offshore operators are currently working on two of the most difficult environments in the entire region, overcoming tremendous obstacles to explore the highly prospective Navarin Basin and Beaufort Sea Planning Areas. Work in the Navarin Basin is being pursued hundreds of miles from the nearest landfall, in the face of some of the world's worst storms that are common in the Bering Sea, and during a drilling season that is limited by the encroachment of ice floes.

In the Beaufort Sea, experience gained in past years' drilling from man-made gravel islands, the first winter's work from CIDS, and activity offshore in the Canadian Arctic are allowing for the introduction of innovative new mobile drilling systems. Use of these mobile systems, some of which are capable of year-round work in Arctic waters, should allow for more flexible and timely exploration of the Beaufort Sea, at less cost.

During 1984 and 1985, exploration work has also been pursued in the Norton Basin, St. George Basin, and Cook Inlet Planning Areas. The lack of commercial discoveries from drilling in these areas has led offshore operators to pursue work in other areas currently believed to be better prospects. Plans for additional exploration in the Norton, St. George, and Cook Inlet areas are uncertain at present.

In State waters, delineation drilling on the Seal Island reservoir is continuing from Northstar Island. The Seal Island discovery was the first to include resources that extended beneath the Alaska OCS. Once delineation work from Northstar is complete, planning for development should proceed.

Final approval for the Endicott Development Project was granted in January 1985. Endicott, the first development in the Beaufort Sea, was controversial, and the U.S. Army Corps of Engineers in approving the project made clear its hesitancy to approve additional similar projects offshore in the Arctic. Causeways extending out from the shoreline of the North Slope are of the greatest concern as their impacts on the flow of Beaufort Sea waters and the marine ecosystem are unknown. The Endicott project will include two breachways to allow for the flow of water and marine life, and extensive environmental monitoring will take place.

The U.S. Army Corps of Engineers is currently preparing an EIS for a second development project causeway in Arctic waters. The Lisburne project calls for a causeway in Prudhoe Bay, however, where alterations in water flows are perceived to have less impact on the ecosystem.

Generalized hydrocarbon transportation scenarios have been developed for production from the Alaska OCS. In most cases, marine pipelines would carry oil or gas from the production wellhead to landfall; from there produced hydrocarbons would be transported by a trans-Alaska pipeline system, a shorter overland pipeline, or icebreaking shuttle tankers to transshipment facilities in ice-free ports for loading onto supertankers and carriage to continental U.S. refineries. Only for the Navarin Basin Planning Area would the scenario vary significantly. Because of the great distance to any landfall, tankers would probably be loaded from an offshore facility sited adjacent to the production well platform.

Recent activities have affected future plans for the transportation of Alaska OCS hydrocarbons. These activities include (1) work on a trans-Alaska gas system to carry Arctic natural gas reserves to Asian markets and (2) a decision by the U.S. Secretary of Transportation to allow supertankers involved in international trade, that were built with U.S. subsidies, to enter into domestic trade (carrying North Slope oil from Valdez to continental U.S. refineries) once they have repaid their subsidies.

If significant discoveries are made in the Alaska OCS Region, major onshore facilities will have to be constructed. Each subregion is unique and has its own set of complex issues and logistical problems associated with this potential development. Onshore development could conflict with other current uses of the coastal zone, such as the subsistence lifestyles of the Native population, fishing, shipping, and logging. As the onshore locations suitable for support facilities are limited and much of the Alaskan coast is fragile, future development will necessitate careful planning and negotiation to ensure that impacts are minimized.

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Appendix A. OCS-Related Studies in Alaska

Numerous studies related to oil and gas activities in the Alaska OCS Region have been or are being conducted. They have been funded by Federal, State, and local agencies, regional organizations, and industry.

There is no single source from which all studies related to Alaska can be obtained. However, there are a number of very good sources of information. One of the best is the Arctic Environmental Information and Data Center (AEIDC). A research unit of the University of Alaska, AEIDC was established in 1972 by the Alaska State Legislature. The information services staff of the AEIDC provides information referrals, develops and maintains specialized information files, and retrieves and distributes information. These services are augmented by computerized data bases. The AEIDC's collection includes unpublished and out-of-print documents. Materials that are not restricted by copyright can be reproduced on microfiche for a small fee. The AEIDC also is a good source of information on ongoing research programs.

The AEIDC publishes **Current Research Profile for Alaska** each year. The most recently published edition is for 1983; the 1984 edition is in progress. Each report contains abstracts of the research in physical, biological, and related social sciences conducted during a given year. For more information concerning AEIDC reports and services, contact the following office:

Arctic Environmental Information
  and Data Center
Information Services
707 A Street
Anchorage, AK 99501
(907) 279-4523

The remainder of this appendix lists sources of studies by Federal and State agencies, local governments and organizations, and industries sponsoring studies. Where possible, compendium reports, study lists, and library addresses are provided.

FEDERAL STUDIES

U.S. Department of the Interior

Alaska Resources Library

There are several sources of Federal studies concerning Alaska. A comprehensive source for studies related to petroleum resources, as well as fisheries, mining, and hydroelectric resources, is the Alaska Resources Library, located in the Federal Building in Anchorage. Although this library primarily collects natural resource documents, it contains some social science and statistical material. The library has a good referral service and allows limited photocopying of library materials without charge. For more information contact the following office:

Ms. Martha Shepard
Alaska Resources Library
Federal Building, Room D-114
701 C Street
Anchorage, AK 99513
(907) 271-5025

U.S. Fish and Wildlife Service

The FWS conducts a number of studies in Alaska. Although there is no published comprehensive listing of its studies, the FWS does maintain a computer listing of them. In addition, the FWS has published a bibliography of Alaskan water bird studies, which was cited in two previous Alaska subregion summary reports:

- Arctic Summary Report, January 1985 (OCS Information Report MMS 85-0022); and
- Bering Sea Summary Report, September 1984 (OCS Information Report MMS 84-0076).

The FWS maintains a library at its Anchorage office that is open to the public. The library contains all Alaska-related FWS publications, and an information specialist is available for questions or guidance. Information on FWS studies can be obtained by contacting

Information Transfer Specialist
FWS Library
1011 E. Tudor Road
Anchorage, AK 99503
(907) 786-3404.

U.S. Geological Survey

The U.S. Geological Survey (USGS) has conducted numerous studies about the Alaska OCS. The last publication listing Alaska studies included reports up to August 1980. It is uncertain whether another Alaska-specific studies list will be published.

The USGS maintains a public library and inquiries office in Anchorage. Information can be obtained by contacting Elizabeth Behrendt at the following office:

U.S. Geological Survey
Public Inquiries Office
4230 University Drive
Anchorage, AK 99508
(907) 561-5555

The following publication is listed because of its relevance to the OCS:

Phillips, R. L., and Reiss, T. E., 1985, Nearshore marine geologic investigations, Point Barrow to Skull Cliff, Northeast Chukchi Sea, USGS Open-File Report no. 85-0050. Available at cost from USGS, Room 207, O'Neill Building, University of Alaska, P.O. Box 80586, Fairbanks, AK 99708.

Minerals Management Service

Secretarial Orders 3071 and 3087 created MMS and transferred to it all functions previously performed by the former Conservation Division of USGS and the Bureau of Land Management (BLM) OCS offices. As a result, studies formerly under contract with BLM's OCS Office have been transferred to MMS.

THE ENVIRONMENTAL STUDIES PROGRAM. The MMS sponsors OCS environmental studies through its Environmental Studies Program. The studies program in Alaska, which began in 1975, has expended close to $200 million dollars and has produced over 400 studies and detailed data to support environmental assessment and other pre- and postlease planning needs.

In the early years of the Studies Program, a major portion of the studies in Alaska were administered through an interagency agreement with the Outer Continental Shelf Environmental Assessment Program (OCSEAP) of the National Oceanic and Atmospheric Administration (NOAA). In recent years, however, a growing number of studies have been managed directly by the Alaska OCS Regional Office.

The OCSEAP program publishes bound volumes of final reports. In addition to reports on individual projects, certain types of data from multiple studies are merged and used to produce tables and maps useful in areawide environmental assessment. Synthesis meetings in each Alaska OCS planning area are conducted to coordinate data from studies in different disciplines, and regional synthesis reports are published. A computerized, comprehensive bibliography of all reports based on MMS- and OCSEAP-funded research is also maintained. For further information and copies of the reports, contact

Program Analyst
NOAA/OCSEAP
701 C Street
Box 56
Anchorage, AK 99513
(907) 271-3652.

The initial Gulf of Alaska Summary Report, September 1980, the Arctic Summary Report, October 1981, and the Bering Sea Summary Report, September 1983, as well as subsequent summary reports and updates (Gulf of Alaska: June 1981, June 1982, April 1983, and May 1984; Arctic: May 1982, January 1983, and September 1983; Bering Sea: September 1984), included citations of many of the major BLM/MMS and NOAA/OCSEAP studies of the Alaska OCS. These studies are no longer listed individually in summary reports because of the large number of projects and reports. However, a bibliography of endangered species reports, and lists of ongoing and completed studies for each of the major Alaska OCS lease sale planning areas are available. For information on environmental studies, contact

Environmental Studies Program
Analyst
Minerals Management Service
Alaska OCS Regional Office
P.O. Box 101159
Anchorage, AK 99510
(907) 261-4588.

Some of the study topics supported by the OCS Environmental Studies Program in Alaska include

- endangered cetacean species, an important component of which is the real-time monitoring of migrating bowhead whales in relation to offshore drilling and seismic-survey activities;
- other marine mammals such as ringed seals, a major subsistence food source;
- Alaskan seabirds;
- fish and shellfish, which are important to Alaska's economy;
- marine ecosystems;
- oil-spill and sediment transport and effects modeling, including models of fisheries/oil-spill interactions and economic effects;
- pollutant monitoring; and
- socioeconomic studies.

The Social and Economic Studies Program

In recognition of the unique cultural conditions in rural Alaska, and in response to Alaskan concern about the potential effects of OCS development on the human environment there, a special Social and Economic Studies Program (SESP) was initiated in the MMS Alaska OCS Region. The SESP is an applied research program that provides social, cultural, political, and economic information and projections of the effects of proposed lease sales and associated oil- and gas-related activities. Topical components of SESP include petroleum technology assessment, statewide or local economic and demographic effects, transportation system effects, and local socioeconomic and sociocultural effects. In much the same way that other Environmental Studies Program projects do, SESP studies provide information needed by MMS for environmental evaluation of proposed lease sales, as well as industry exploration and development plans and for monitoring of oil and gas development. A bibliography of SESP studies is available from the above address.

The MMS Alaska OCS Regional Office also produces research and reference papers on the geology and other various environmental issues pertaining specifically to proposed oil and gas lease sales. These are available from

Office of Leasing and Environment
Minerals Management Service
Alaska OCS Regional Office
P.O. Box 101159
Anchorage, AK 99510
(907) 261-4080.

In addition to the social and economic and environmental studies supported by MMS, two other programs study the technology necessary for safe and efficient OCS oil and gas development operations. The first program, the Technology Assessment and Research Program, provides technology support and technical services to MMS offshore management personnel as they operate with industry. The goal of the program is to ensure that the best available and safest technology is used on the OCS. Functions of the Technology Assessment and Research Program are divided into three categories: structures and pipeline behavior and inspection, well control, and oil-spill containment and cleanup. As offshore operators move into new frontier areas for exploratory work, the emphasis of the program shifts. Arctic engineering and methods for dealing with oil spills in waters where ice is present are among the most significant current focuses of study.

The second program related specifically to technology assessment and research is the oil-spill countermeasures program directed by the Oil and Hazardous Materials Simulated Environmental Test Tank (OHMSETT) Interagency Technical Committee (OITC), which is chaired by MMS. Other members of OITC include the U.S. Coast Guard, the Environmental Protection Agency (EPA), the U.S. Navy, and the Environmental Protection Service of Canada. The program is concentrating on developing capabilities for open water and for winter operations, specifically work in broken or solid ice conditions. Three projects are currently active.

The first project, a study of booms and skimmers for OCS work, is being conducted in three phases. The first phase involves simulations in the OHMSETT operated by EPA. The second undertakes assessment of equipment capability for seaworthiness and durability. The final phase, planned to begin in fiscal year 1988, involves exposure of equipment under OCS conditions to a series of intentional oil spills.

Another OITC project involves a series of spilled oil-burn tests. Begun in 1984, this project assesses the potential for burning oil in broken ice as a mitigation measure.

The third OITC project is the Spill of Opportunity Program (SPORT). The project is designed to instrumentally assess performance of equipment at actual spills, although the program focus will change as it matures. Fortunately, the number of recent offshore oil spills has been low, so there has been no opportunity to employ SPORT.

Further information on these MMS technology-oriented programs is available from

John B. Gregory
Chief, Technology Assessment
and Research Branch
Minerals Management Service
12203 Sunrise Valley Drive, MS 647
Reston, VA 22091
(703) 860-7865.

A good overall source of MMS OCS-related scientific and technical publications generated by various components of the MMS offshore program is the Technical Publications Unit (TPU) within the Office of Offshore Information Services. Since January 1984, the TPU has classified these documents into general series and assigned them uniform publication numbers. The TPU produces a periodical bibliography, **Offshore Scientific and Technical Publications,** which includes a listing of new publications, a cumulative (chronological) listing, and a listing organized by OCS regions; each entry in these listings also provides information on where each publication may be obtained and the price, if there is a charge. To receive this periodical listing or for more information, contact

Chief, Technical Publications Unit
Office of Offshore Information
Services
Minerals Management Service
1951 Kidwell Drive, MS 642
Vienna, VA 22180
(703) 285-2604.

Most Alaska Environmental Studies Program reports are available for review at the

Library, Alaska OCS Region
Minerals Management Service
P.O. Box 101159
Anchorage, AK 99510
(907) 261-4435.

U.S. General Accounting Office

The U.S. General Accounting Office (GAO), an independent agency of the legislative branch, produces a series of topical reports on a wide range of subjects in response to requests for information from committees or Members of Congress. The final versions of these reports are available to the public. The GAO also produces a list of its reports issued in the preceeding month. The first five copies of any report are available at no charge; additional copies must be ordered prepaid. For more information or to order reports, contact

U.S. General Accounting Office
Document Handling and Information
Services Facility
P.O. Box 6015
Gaithersburg, MD 20760
(202) 275-6241.

U.S. General Accounting Office, 1983, Pros and cons of exporting Alaskan North Slope oil, GAO/NSIAD-83-69. Washington, D.C.: 26 p.

U.S. General Accounting Office, 1984, Economic effects of cargo preference laws, GAO/OCE-84-3. Washington, D.C.: 40 p., including appendices.

Comptroller General, 1983, Early assessment of Interior's area-wide program for leasing offshore lands, GAO-RCED-83-66. Washington, D.C.: 102 p., including appendices.

Comptroller General, 1983, Issues facing the future use of Alaskan North Slope natural gas, GAO/RCED-83-102. Washington, D.C.: 145 p., including appendices.

STATE OF ALASKA STUDIES

The State of Alaska maintains a library that holds all studies and reports conducted by State offices. The library, which is open to the public, is located on the eighth floor of the State Office Building on Willoughby Avenue in Juneau, Alaska.

Department of Community and Regional Affairs

The Division of Municipal and Regional Assistance (DMRA), within the Alaska Department of Community and Regional Affairs, publishes a number of planning and policy reports, many of which focus on local areas. The last published bibliography of its general reports covers the period from 1978 to October 1982. An updated version is forthcoming. The division also prepares a series of descriptive community profiles that focus on villages and communities throughout Alaska. The DMRA has a distribution library at 150 Third Street in Juneau. For information on its reports and a listing of its community profiles, the library can be reached by calling (907) 465-4750.

Division of Municipal and Regional Assistance, 1982, Bibliography of Alaska planning reports, Juneau. Available from Division of Municipal and Regional Assistance, Pouch BH, Juneau, AK 99811.

Department of Fish and Game

Various divisions within the Alaska Department of Fish and Game conduct studies. Although the department does not publish a list of its studies, it does maintain two libraries and a public information service. Information requests should be directed to the department's Public Communication Section at (907) 456-4112.

The Department of Fish and Game's Habitats Division maintains a library at 333 Raspberry Road, Anchorage, AK 99502. Inquiries should be directed to the librarian, Lauren Barker, at (907) 267-2312.

The Department of Fish and Game's other library primarily houses studies sponsored by the Commercial Fisheries Division and the Fisheries Rehabilitation and Enhancement Division. The library's address is P.O. Box 20, Douglas, AK 99824. The librarian, Paul Desloover, can be reached at (907) 465-4119.

Department of Natural Resources

The Alaska Department of Natural Resource's resource library contains all its publications and is located at C Street and 36th Avenue, Anchorage, AK 99510. The phone number is (907) 561-2020.

The Governor's Agency Advisory Committee on Leasing, which is co-chaired by the Commissioner, Department of Natural Resources, and the Associate Director, Office of Management and Budget, prepares information to support decisions concerning State leasing and also monitors the Federal leasing process. A social, economic, and environmental analysis is prepared for each State lease sale. Each analysis includes a bibliography of State agency resource studies. They are available from the Agency Advisory Committee on Leasing, Alaska Division of Oil and Gas, Pouch 7-034, Anchorage, AK 99510.

The Division of Geological and Geophysical Surveys maintains a library of its publications at its office at 3601 C Street, Anchorage, Alaska; (907) 561-2020. The division also prepares a list of its publications that is updated at least once a year.

Alaska Division of Geological and Geophysical Surveys, Department of Natural Resources, 1983, List of formal reports issued by the Alaska Division of Geological and Geophysical Surveys. Information Circular 11, Anchorage, Alaska. Available from Alaska Division of Geological and Geophysical Surveys, Pouch 7-005, Anchorage, AK 99510.

The Division of Oil and Gas administers the State's oil and gas leasing program and conducts various resource studies; however, it does not compile a bibliography. Requests for information about their studies should be directed to the Alaska Division of Oil and Gas, Pouch 7-034, Anchorage, AK 99510; (907) 265-4294.

Alaska Department of Natural Resources, 1983, Five-year oil and gas leasing program, January 1983, Anchorage, Alaska. Prepared for the second session, 14th Alaska Legislature, 147 p. Available by contacting the Alaska Division of Oil and Gas at the address listed above.

Department of Transportation and Public Facilities

The Alaska Department of Transportation and Public Facilities sponsors planning and engineering studies for Alaskan communities out of its Fairbanks office. Although the department does not prepare a list of its reports, it does maintain them at its library at 600 University Avenue, Fairbanks, AK 99701. Requests for information on the department's reports should be directed to that address, or call (907) 479-4281.

University of Alaska

Unless otherwise indicated, the following publications may be obtained, free of charge, from the following address:

Publications
Institute of Social and Economic
Research
707 A Street, Suite 206
Anchorage, AK 99501
(907) 278-4621

Berman, Matthew, 1983, Alaska North Slope oil production and revenue projections. Anchorage, Alaska: Alaska Review of Social and Economic Conditions, vol. 22, no. 1, February 1985, 12 p.

-----, 1983, OCS revenue sharing in Alaska. Anchorage, Alaska: Institute of Social and Economic Research, Research Summary no. 26, January 1983, 2 p.

Berman, Matthew, and others, 1984, Alaska petroleum revenues: The influence of Federal policy. Anchorage, Alaska: Institute of Social and Economic Research, report to the Office of the Governor of Alaska, Anchorage, 218 p. and appendix, 186 p. (A photocopying charge of 10 cents per page will apply.)

Morehouse, Thomas, A. (ed.), 1984, Alaskan resources development: Issues of the 1980s. Boulder, Colo.: Westview Press, Inc., 211 p. Available from Westview Press, Inc., 5500 Central Avenue, Boulder, CO 80301 ($20).

-----, 1984, Alaska resources development: What beyond Prudhoe Bay? Anchorage, Alaska: Institute of Social and Economic Research, Research Summary no. 17, March 1984, 4 p.

Morehouse, Thomas, and McBeath, Gerald, 1983, Effects of oil revenues on State aid to local governments in Alaska. Anchorage, Alaska: Alaska Review of Social and Economic Conditions, vol. 20, no. 4, September 1983, 20 p.

Tussing, Arlon, 1983, Use in Alaska of North Slope natural gas. Anchorage, Alaska: Alaska Review of Social and Economic Conditions, vol. 20, no. 2, April 1983, 20 p.

INDUSTRY STUDIES

Lease Planning and Research Committee

A listing of industry research projects on the Alaska OCS is prepared by the Lease Planning and Research Committee (LPRC) of the Alaska Oil and Gas Association. The most recent listing cites more than 300 studies for areas throughout Alaska from 1970 to the present. The studies are sponsored by individual oil companies or by groups of companies. Many of the studies are engineering related and may contain proprietary information.

Brief reviews of ongoing industry projects can be found, along with feature articles, in the LPRC's research review periodical, **Alaskan Update.** Subscriptions are free to organizations or individuals. Contact

Ray Piper
Editor, Alaskan Update
c/o Ray Piper Company, Inc.
P.O. Box 270718
Houston, TX 77277.

Fraker, Mark A., 1984, *Balaena mysticetus*: Whales, oil and whaling in the Arctic. Anchorage, Alaska: Sohio Alaska Petroleum Company, 38 p. and bibliography. Available from the Government and Public Affairs Department, Sohio Alaska Petroleum Company, P.O. Box 6612, Anchorage, AK 99502-0612.

Lease Planning and Research Committee, Alaska Oil and Gas Association, 1983, A compilation and description of industry research projects in Alaska frontier OCS areas: Anchorage, Alaska. Available from Public Relations Manager, Alaska Oil and Gas Association, 505 W. Northern Lights Boulevard, Anchorage, AK 99503.

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Appendix B. OCS-Related Issues in Alaska

COASTAL ZONE MANAGEMENT

The Coastal Zone Management Act (CZMA) of 1972 was enacted to promote the wise use and management of the Nation's coastal resources. It was designed as a voluntary program, to encourage the individual States to manage their coastal areas within Federal guidelines, through federally approved coastal zone management programs (CZMP). The two incentives provided to the States to participate were Federal dollars to develop and maintain (on a cost-sharing basis) the State program and the requirement that all Federal activities "directly affecting" the coastal zone be consistent with the State CZMP.

Original "seed money" was provided by Congress through grants and loans in its appropriations for the CZMA to all States actively pursuing or implementing CZMP's. Once the programs were established, according to the CZMA, States were to begin taking fiscal responsibility for coastal zone management. Congress appropriated funds during fiscal years 1983, 1984, and 1985, overriding zero-funding proposals submitted by the President. The growing economic dilemma of the Federal Government in recent years has precipitated reduced funding, and the administration continues to pursue the goal of terminating this "seed money." The reduced funding levels have instigated searches for alternative funding sources; one such alternative source could be OCS revenue sharing, a proposition that has been extensively debated in Congress.

In addition to funding, a second incentive for States to set up CZMP's was legislated by Congress: a clause in the CZMA requires OCS exploration or development plans to be submitted to the States for their concurrence with industry's certification of consistency with the programs developed by States. A 1984 Supreme Court ruling involving consistency has further defined States' rights in this controversial issue.

Consistency Determination

On January 11, 1984, the Supreme Court ruled on the landmark case **Secretary of the Interior v. California** (U.S. Supreme Court No. 82-1326, Jan. 11, 1984). This case focused on the applicability of section 307(c)(1) of the CZMA to Federal prelease OCS activities. The case resulted from a 1981 California Coastal Commission decision that the offering of certain northern tracts in Lease Sale 53 off California's central and northern coast would be inconsistent with its coastal plan. Eleven other coastal States filed amicus, or "friend of the court," briefs supporting California in this litigation.

Ruling for the Secretary of the Interior, the Supreme Court's decision states that OCS lease sales are not events that "directly affect" the coastal zone within the meaning of section 307(c)(1). Lease sales need not, therefore, be consistent with federally approved State CZMP's. The majority opinion of the Court noted that OCS lease sales occur outside a State's territorial sea and do not, in and of themselves, produce a direct effect on the coastal zone. Instead, the Court interpreted congressional intent under the CZMA to mean that the consistency provisions of the act are applicable only to postlease activities.

In essence, the ruling has established that coastal States with federally approved coastal zone management plans possess consistency review powers over exploration, development, and production activities of OCS lessees; this power is not, however, applicable to OCS lease sales or other prelease activities of DOI. This case has clarified the legal controversy surrounding the consistency issue with respect to OCS lease sales.

On June 1, 1984, the National Oceanic and Atmospheric Administration (NOAA) announced (49 FR 22825-22827) its intent to review the existing regulations implementing the CZMA to determine which regulations needed revisions as a result of the Supreme Court decision. Following a 90-day public review period, NOAA issued a proposed rulemaking (50 FR 3798-3801) on January 28, 1985, to amend its existing regulations to exclude OCS oil and gas lease sales from the Federal consistency requirements of section 307 of the CZMA. The comment period for this proposed rule ended on March 1, 1985, and final rulemaking (50 FR 35210-35213) was issued on August 30, 1985.

In addition, NOAA performed a study of Federal consistency, examining statistical information and case studies on how the Federal consistency process has affected several key types of activities. A draft of this study was made available for public comment until August 31, 1985. The final study will be released early in 1986. For further information on the final rulemaking or the Federal consistency study, contact

Nan Evans
Office of Ocean and Coastal
  Resource Management
National Oceanic and
  Atmospheric Administration
3300 Whitehaven Street, NW.
Washington, DC 20235
(202) 634-4249.

CZMA Reauthorization

Congressional authorization for the CZMA of 1972 expired on September 30, 1985. Several reauthorization bills for the act have been introduced in the 99th Congress. One of these, the Coastal Zone Management Reauthorization Act of 1985 (H.R. 2121), was reported by the House Merchant Marine and Fisheries Committee on May 1. A similar bill, S.959, was reported by the Senate Committee on Commerce, Science, and Transportation on May 9. The debate over CZMA reauthorization centers on two issues: (1) the need for the continued contribution of Federal funds and (2) the applicability of the consistency provision to OCS lease sales.

On July 30, H.R. 2121 passed the House with an amendment that would freeze authorization levels at the fiscal year 1985 appropriations in 1986 and subsequently provide decreasing levels of Federal support in future years. The first session of the 99th Congress closed without the Senate taking any action on the legislation passed by the House. The reauthorization, therefore, remains pending Senate action in the second session, which opens in early 1986.

Alaska Coastal Management Program

The Alaska Coastal Management Program (ACMP) is based on the Alaska Coastal Management Act of 1977 and the Federal CZMA of 1972, as amended (16 U.S.C. 1451 et seq.). The ACMP received Federal approval in July 1979. The program is composed of approved district (local and regional) coastal management programs and general standards and guidelines for development in the coastal area. The program is intended to promote a coordinated and balanced use of Alaska's coastal resources.

During 1983, the Alaska Legislature granted authorization to allow reorganization of coastal management responsibilities within the Governor's office. Under the new structure, the Alaska Coastal Policy Council (CPC) and the Office of Coastal Management were assigned to the Division of Governmental Coordination (DGC) within the Governor's Office of Management and Budget.

The ACMP established local coastal districts and allowed unorganized areas to form Coastal Resource Service Areas

(CRSA). Coastal resource districts (including local governments and CRSA's) are eligible to develop local coastal management plans (CMP) following standards and guidelines issued by the State under the ACMP. These local CMP's are reviewed and approved by the CPC. The ACMP and the local coastal resource district CMP's provide coastal planners with a statutory basis for directing coastal development. Provisions of the CZMA can be employed to ensure that development projects within and adjacent to the coastal zone are conducted in a manner consistent with federally approved local and State CMP's. In the event that a local coastal resource district does not develop a CMP and the CPC anticipates major economic activity in the area (such as Federal OCS or State offshore leasing), the CPC may direct the Alaska Department of Community and Regional Affairs to prepare a CMP for the area.

Recent events of importance include the following:

- The Cenaliulriit (Yukon-Kuskokwim CRSA) program was approved by the CPC on October 11, 1984. The Cenaliulriit program was filed with the Lieutenant Governor and went into effect on March 11, 1985.

- The Bristol Bay CRSA program was approved by the CPC on February 6, 1985, with the changes recommended by the staff. The program was submitted to the Federal Government on February 14, 1985. The Federal Office of Ocean and Coastal Resource Management has indicated that the program will be treated as a significant amendment requiring a thorough Federal review.

- The North Slope Borough program was approved by the CPC on April 17, 1985. The program was submitted to the Federal Government during May and also is being treated as an amendment.

- District coastal management programs for Craig, Kake, and Klawock were filed with the Lieutenant Governor and took effect for State and Federal consistency on May 31, 1985. A routine program implementation change for Sitka also went into effect on May 31.

- The Aleutians East CRSA program was conceptually approved on May 8, 1985. The program was submitted to DGC in June to begin the council's review process. The conceptually approved draft and DGC's preliminary findings and conclusions on the program were distributed for review in early July.

The CPC adopted changes to ACMP regulations relative to the designation of areas that merit special attention (AMSA) on February 7, 1985. These changes clarify the distinction between AMSA's inside and outside districts and set procedures for the designation of AMSA's outside districts. Revised regulations for AMSA's inside districts were adopted by the CPC on October 30, 1985.

The DGC submitted these regulation changes to the Department of Commerce, Office of Ocean and Coastal Resource Management, for review. The changes were subsequently approved, as provided in 15 CFR 923.84. These regulations have been filed with the Lieutenant Governor's office and went into effect on June 10, 1985.

Table 15 lists the coastal resource district documents that make up the ACMP, programs that will soon be incorporated in the ACMP, and programs recently conceptually approved.

TABLE 15.—Status of district programs of the Alaska Coastal Management Program

District	Program title and release date
Approved programs that make up the ACMP	
Municipality of Anchorage	o Anchorage CMP Resource Policy Unit Maps, April 1979 o Anchorage CMP - reprinted version, January 1981 o Anchorage Coastal Scenic Resources and Public Access Plan, 1981 o Anchorage Wetlands Management Plan - revised February 1982
Annette Islands Indian Reserve	o Annette Islands CMP, November 1979 - State and Federal consistency not applicable
City of Bethel	o Bethel CMP, June 1983
Bristol Bay Borough	o Bristol Bay Borough CMP, June 1983, Addendum #1, December 28, 1983
Cenaliulriit	o Cenaliulriit CMP, March 1985
City of Craig	o Craig CMP, May 31, 1983
City of Haines	o Haines CMP, October 1979 o Refinements to Haines CMP, November 1980 o Port Chilkoot/Portage Cove AMSA, 1982
City of Hoonah	o Hoonah CMP, June 1984
City of Hydaburg	o Hydaburg CMP, January 1983 o Council order of approval, April 1983
City of Kake	o Kake CMP, May 31, 1983
Ketchikan Gateway Borough	o Ketchikan CMP, July 1983 o Council order of approval, December 1983
City of Klawock	o Klawock CMP, May 31, 1983
Kodiak Island Borough	o Kodiak Island Borough CMP, June 1983 o Kodiak Island Borough CMP Progress Report Resource Inventory, June 1983 o Kodiak Island Borough Resource Maps o Addendum #1 to the Kodiak program, March 1, 1984
Matanuska-Susitna Borough	o Matanuska-Susitna Borough CMP, Concept Approved Draft, July 1983 o Addendum #1, February 13, 1984 o Addendum #2, April 26, 1984
City of Nome	o City of Nome CMP, October 1983, Revised Concept Approved Draft
City of Pelican (Oct. 15, 1984)	o City of Pelican, Concept Approved Draft, March 1984 o Council order of approval, June 1984
City and Borough of Sitka	o Sitka CMP - reprinted version, April 1983
City of Skagway	o Skagway CMP - amended version, September 1982 o Council order of approval, April 1983
City of Yakutat	o Yakutat CMP, January 1981

TABLE 15.—Status of district programs of the Alaska Coastal Management Program—Continued

District	Program title and release date
Areas meriting special attention (AMSA) outside districts	
Southern Southeast AMSA's	• Areas Which Merit Special Attention in Southern Southeast Alaska, July 1, 1983
Programs soon to be incorporated into the ACMP or recently conceptually approved	
Aleutians East	• Coastal Resource Service Area - program awaiting Federal approval
Bristol Bay	• Coastal Resource Service Area - program awaiting Federal approval, environmental assessment underway
City of Cordova	• Awaiting CPC approval of Eyak • Lake AMSA Plan and Amendments to the District Boundary
North Slope Borough	• Program awaiting Federal approval, environmental assessment underway

SOURCE: National Oceanic and Atmospheric Administration, 1985.

SECTION 8(g)

Section 8(g) of the OCS Lands Act (43 U.S.C. 1337(g)), as amended in 1978, requires a "fair and equitable" distribution of revenues between the Federal Government and a coastal State for Federal lease blocks within 3 miles of the seaward boundary of the State that may contain oil and gas pools underlying both OCS and State lands. When a Federal lease is to be offered within this 8(g) zone, the Secretary of the Interior must attempt to reach agreement with the Governor of the adjacent coastal State on sharing Federal revenue if the proposed lease contains at least one common oil or gas pool. If no agreement is reached, the lease sale can still be held, but revenues from leases in the 8(g) zone that contain common pools are to be placed in an interest-bearing special account until an accommodation can be reached or a district court ruling is made concerning division of the funds. As of March 31, 1985, some $5.8 billion had accumulated in Section 8(g) accounts for leases off Alabama, Alaska, California, Florida, Louisiana, Mississippi, and Texas.

In August 1984, then Secretary William Clark offered to share 16-2/3 percent of the bonus and rental payments and appropriate interest from the 8(g) account with Alabama, Alaska, California, Florida, and Mississippi. Royalties would be disbursed according to unitization agreements or equivalent royalty offset agreements. While Texas and Louisiana were not included in the offer because of pending litigation, it was hoped that agreement could be reached on the same terms with these two States. The DOI has continued to meet with representatives of all seven States, including a meeting on February 23, 1985, between Secretary Hodel and the Governors of the 8(g) States. On April 16, 1985, six of the Governors delivered a counteroffer to Secretary Hodel proposing the States receive 37.5 percent of the lease bonuses, rentals, royalties, and

Federal taxes from the disputed tracts. The California Governor decided not to participate in the State offer.

The Federal budget proposal passed by the House of Representatives in May contains a provision to divide the 8(g) funds, giving the involved coastal States 27 percent of the money. On June 20, the Reagan administration announced its approval of the formula contained in the House budget resolution. The amount of money each State would receive under this agreement has been estimated by DOI: Louisiana, $485 million; California and Texas, $375 million each; Alabama, $70 million; Alaska, $44 million; Mississippi, $14 million; and Florida, $30,000.

Several bills have been introduced in Congress by House as well as Senate Members proposing to amend the OCSLAA with respect to distribution of Section 8(g) revenues. Included in these proposals are other amendments, such as strengthening the Federal-State consultation process under section 19, the 5-year leasing plan approval process, and information-sharing provisions. None of these legislative bills has passed committee hearings yet, and it is expected that they will undergo extensive scrutiny before passage of a final bill.

On September 3, 1985, the State of Alaska filed suit in U.S. District Court (A85-502 Civil) in Anchorage asking for a 50-50 split of the disputed revenues. The suit also claims that the Federal Government failed to deposit at least $420 million in the escrow account that was set up to hold 8(g) revenues until a settlement is reached. The litigation is still pending at the time of this writing.

OFFICE OF TECHNOLOGY ASSESSMENT REPORT

Much of the Nation's future domestic petroleum supply is expected to come from the OCS. Areas of highest potential are thought to be in deep water and in the Arctic where severe operating conditions and high development costs create immense financial risks.

The Office of Technology Assessment (OTA) released a study in May 1985 entitled "Oil and Gas Technologies for the Arctic and Deepwater," that explored the range of the technologies required for exploration and development of offshore energy resources and assessed associated economic factors and financial risks. Among the findings of the study were the following:

- The existing OCS Lands Act Amendments (OCSLAA) appear to provide Congress and the executive branch sufficient latitude to guide the leasing program in any direction that public policy may dictate. In general, the Amendments allow the administrative flexibility needed to adjust leasing terms and conditions to deepwater and arctic frontier areas.

- Development of offshore technology appears to be progressing at a pace compatible with government leasing schedules and projected exploration and development timeframes.

- There may be a need for new approaches to preventing work-related injuries and fatalities in coping with new hazards in the hostile Arctic and deepwater frontiers.

The OTA has identified policy options for expediting the safe and orderly exploration and development of oil and gas in deepwater and Arctic offshore regions and for providing additional incentives to industry. Copies of the report (Government Printing Office stock no. 052-003-00995-1) can be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

COMPREHENSIVE OIL POLLUTION LIABILITY AND COMPENSATION LEGISLATION

Oil pollution liability legislation has been proposed in the House of Representatives since 1975, but has yet to win the approval of Congress. Such legislation is intended (1) to ensure that operators of vessels, deepwater ports, and structures on the OCS will assume a sufficient degree of liability for damage and removal costs of spilled oil and (2) to make certain that adequate funds will be available to pay for costs in excess of liability limits. These excess costs would be covered through the consolidation of four existing cleanup funds into a single $200 million trust fund, financed through a 1.3-cent-per-barrel tax on imported or exported oil.

The Comprehensive Oil Pollution, Liability and Compensation Act (H.R. 1232), introduced in the 99th Congress in February 1985, is similar to that which passed the House of Representatives last year. However, this year's bill contains three significant changes added to remove the administration's objections to the earlier proposal.

The major change is an increase in vessel liability limits to approximate those of the International Maritime Organization. Liability for a vessel carrying bulk oil as cargo would be set at $420 per gross ton (pgt), with a minimum of $3 million and a maximum of $60 million. This represents an increase from a $400 pgt liability, up to a $40 million maximum, from the earlier proposal. Inland oil barge liability would remain at $150,000 or $150 pgt, whichever is greater; OCS structures and deepwater ports would stay at a flat $50 million liability. Additionally, the legislation would provide for a $20 million refund within the general U.S. Treasury to cover part of the unreimbursed oil-spill cleanup costs incurred under the Clean Water Act since 1972. The bill would also place the management of the $200 million trust fund within the Department of Transportation, rather than a private organization as in earlier versions.

The administration has expressed support for H.R. 1232, which had been attached to legislation reauthorizing the superfund hazardous waste cleanup program (H.R. 2817). At the close of the 99th Congress' first session, the superfund legislation had been attached by both the House and Senate to the Social Security Minor and Technical Changes Act (H.R. 2005). The legislation is expected to be approved by Congress early in 1986.

Copies of H.R. 1232, H.R. 2817, or H.R. 2005 may be obtained by writing to the following office:

House Document Room, H-226
U.S. Capitol
Washington, DC 20515

ALASKA CLEAN SEAS

Alaska Clean Seas (ACS) is an industry cooperative effort begun in 1979 to allow for quick response and rapid deployment of oil-spill cleanup equipment in Alaska State and OCS waters. The current equipment inventory is valued at $12 million and serves exploratory drilling operations in all Alaska OCS areas except part of the Cook Inlet, which has its own response team.

The primary goals of ACS are to maintain and service the detection, containment, recovery, disposal, collection, transfer, and storage equipment that enables operating personnel to respond with the speed and confidence required by a major spill. Of secondary importance are research and development projects and the training of industry personnel in the use of spill abatement technology. Recent research and development projects that ACS has been involved with have focused on testing the laser ignition system for the in situ burning of oil on sea ice. Other research areas have included the use of chemical dispersants, electronic detection devices, and deployment drills for booms and dikes.

The Alaska Beaufort Sea Oil Spill Response Body (ABSORB) facility at Deadhorse has by far the most comprehensive collection of ACS equipment in Alaska. In addition to the ABSORB warehouse at the North Slope, ACS has facilities in Anchorage, Dutch Harbor, and seasonally in Nome. Table 16 provides a condensed equipment list for the various ACS facilities.

COAST GUARD SAFETY LEGISLATION

On March 7, 1985, the U.S. Coast Guard issued a notice (50 FR 9290-9292) soliciting comments on Coast Guard OCS regulations concerning inspection of fixed facilities, workplace safety, fire protection, evacuation standards, lifesaving equipment, personnel training, and casualty data collection. The project is the second major phase of the Coast Guard's effort to implement the provisions of the 1978 OCSLAA. It is intended to address new developments in the offshore industry, applicable interagency agreements, and problems identified by casualty investigations.

In the area of fixed-facility inspections, the Coast Guard has proposed that annual inspections be conducted by the facility owners or a third party employed by the owner. Coast Guard inspectors would then perform periodic, unannounced inspections of fixed facilities, particularly those that are manned or that have a poor safety record. The notice requests comments on improving current regulations for fire protection, including provisions for structural protection to allow escape or to protect living areas, a requirement for control measures, and a requirement for personal protection equipment.

The Coast Guard also requested comments on the adequacy of current regulations concerning evacuation and lifesaving equipment standards for OCS facilities. This request is in response to investigations by the Coast Guard's Marine Board of Investigation and the National Transportation Safety Board into the 1982 sinking of the mobile drilling rig **Ocean Ranger**. Both reports recommended that the Coast Guard require standby vessels for all mobile drilling units on the OCS. In addition, legislation has been introduced in the House of Representatives to require a standby vessel for all manned installations on the OCS. While voluntary positioning of a standby vessel with each mobile unit was customary until 2 years ago, a few companies have reduced the use of standby vessels as the oil market declined. The Coast Guard intends to study the relationship between standby vessels and the facility's primary lifesaving equipment, to determine whether standby boats would enhance safety on the OCS. The Coast Guard plans to publish a proposed rule in June 1986 and have a final regulation in place by July 1987.

For further information, consult the **Federal Register** notice (40 FR 9290-9292) or contact

Lt. Commander Alan J. Cross
Office of Merchant Marine Safety
U.S. Coast Guard
2100 Second Street, SW.
Washington, DC 20593
(202) 426-2307.

FUTURE PUBLIC SALE OF NATIVE CORPORATION STOCK

The Alaska Native Claims Settlement Act (ANCSA) of 1971 provided for the establishment of 12 regional Native corporations within the State. In addition to the nearly $1 billion fiscal settlement, the regional corporations received title to 16 million of the total 40 million acres under the land settlement provision of the ANCSA (McBeath and Morehouse, 1980). The more than 200 village corporations formed within the regional corporations received title to 22 million acres, while the remaining 2 million acres were designated

TABLE 16.—Alaska Clean Seas equipment list

Item	Quantity by location			
	Deadhorse	Nome[1]	Dutch Harbor	Anchorage
Detection Equipment				
Gas/oxygen detectors	2			
Gas analyzer	1			
MSA gas/oxygen alarm model 269			1	
Current meter	1			
Ice augers	8			
Orion tracking system	1	1	1	
Marker stakes	1,000			
IBM PC - trajectory modeling				1
Data base for trajectory modeling	1	1	1	
Containment Equipment				
Heavy-duty Goodyear Sea Sentry (ft)	2,035			
Ocean dike (ft)	5,400			
EPI mini boom (ft)	3,000			
American Marine Simplex (ft)	3,000			
Kepner reel pack (ft)	4,000	1,000		
Whittaker Expandi boom (ft)		1,500	3,000	
Acme corral boom (ft)			3,000	
Boom marker lights			20	
250' Mooring systems (boxes)	4			
400' Mooring systems (boxes)	10			
Fire containment boom (ft)	2,500			
Recovery Equipment				
ARCAT II with 12-man life raft	1			
3M Sorbent boom Type 280 (bales)	250			
3M Sorbent Type 100 (rolls)	507	12	12	17
3M Sorbent Pads Type 151 (bales)	269			
3M Sorbent Pads Type 157 (bales)	400			
3M Sorbent Boom Type 270 (bales)		60	60	
3M Sorbent Type 156 (bales)				32
3M Sorbent Type 126 (bales)				10
3M Sorbent Type 356C (boxes)	85			
Conweb Sorbent blanket (bales)				50
Conweb Sorbent pads (bales)				19
MI-30 disk skimmer	1			
Weir skimmer	10			
Z14-E rope mop	10			
Barracuda rope mop	1			
MW 62 rope mop skimmer	2			
Trans-vac with manta ray skimmers	2			
Acme skimmer			2	
SOCK skimmer			1	
Komara miniskimmer			2	
Halliburton fast response unit		1		
Halliburton skimming barrier with mooring system		1	1	
Walosep skimmer			1	

TABLE 16.—Alaska Clean Seas equipment list—Continued

Item	Quantity by location			
	Deadhorse	Nome[1]	Dutch Harbor	Anchorage
Disposal Equipment				
Igniters	1,700			
Dispersant (drums)	25	10	10	160
Fire containment boom (ft)	2,300*			
Helicopter spray unit				2
Skip spray unit				1
Hand spray unit			3	
Kewanee Boil & Greer separater tank				1
Clean fire portable incinerator				1
Trecan portable incinerator[2]				1
Flaring burner[2]				
Collectant Equipment				
Exxon OC5 (drums)				5
Transfer Equipment				
3/4" Arctic suction hose (ft)	25			
2" Arctic suction hose (ft)	1,620			
3" Arctic suction hose (ft)	4,020	600	600	
3" suction hose (ft)			200	
4" suction hose (ft)			200	
3" Arctic discharge hose (ft)	2,000	1,800	1,000	
3" discharge hose (ft)			400	
4" discharge hose (ft)			400	
Destroil pump	1			
Briggs-Stratton diaphragm pump	10			
Warren Rupp air-operated diaphragm pump	3	3	3	
Warren Rupp air-operated sludge pump	3	3	3	
Barge hatch covers	9	3	3	
Wisconsin-Robin trash pump	10			
Gorman Rupp 4" pump			4	
Hydraulic power pack			1	
Oil/water separaters (200 barrels)			2	
Oil/water separaters (105 barrels)			2	
Storage Equipment				
Firestone Fabritanks 2,230 gal.	20			
Firestone Fabritanks 4,400 gal.	4			
Firestone Fabritanks 25,000 gal.			2	
Trellecon bladder	1			
Dracone barges 2,400 gal.	4			
Dracone barges 2,300 gal.			2	

[1] Equipment is stored in Dutch Harbor from September to June each year. From June to September, equipment is located in Nome when there are drilling activities in the Norton Sound area.

[2] On loan from U.S. Coast Guard.

*Same 2,300 feet of fire containment boom that appears under Containment Equipment.

NOTE: In addition, logistical equipment (facilities, life support systems, vessels, vehicles, and communications) are at the various locations suited to their projected response requirements.

SOURCE: R. Mark Johnson, 1985, Alaska Clean Seas, Anchorage, September 19, oral commun.

as special purpose lands for use by all regional corporations (McBeath and Morehouse, 1980).

While the ANCSA has not made all Natives financially independent, it has materially improved the general outlook for Native communities, most of which were once barren of significant capital or employment opportunity.

The future of the land-claims settlement is not entirely secure because after 1991 shares of the Native corporations' stock are to be reissued. Under the ANCSA, Native shareholders may sell their holdings after that time to the highest bidder.

The Native groups organized under the Alaska Federation of Natives (AFN) are proposing amendments to ANCSA to protect Native lands from going public in 1991 (Martha Fox, 1985, Alaska Governor's Office, Washington, D.C., October, oral commun.). This is particularly true for lands important to subsistence uses. The goal of the AFN is to protect Native lands from takeover by non-Native corporations as well as from stockholders within the regional corporations who would sell to the highest bidder lands that rural Alaska Natives staged a long campaign to acquire.

EXPORT OF ALASKAN CRUDE OIL

On October 25, 1985, the Governor of Alaska announced a tentative agreement between the President of the United States and the Prime Minister of Japan allowing the export of limited quantities of Alaskan crude oil to Japan. Alaska's congressional delegation and other elected officials from the State have long encouraged the easing of export restrictions on Alaska's hydrocarbon resources.

Under the agreement, as briefly outlined by the Governor, Alaska would be allowed to export approximately 6,000 bpd from its royalty share of oil produced offshore in the Cook Inlet. Export of this oil requires a license from the U.S. Commerce Department's International Trade Administration. By the end of 1985, proposed rules for granting the export licenses were issued as a result of an Executive order by President Reagan following the recommendation of his Economic Policy Council (Oil Daily, 1986).

Export of larger quantities of crude oil from either the North Slope or the Alaska OCS would require congressional action amending several laws that currently restrict export of domestically produced crude oil (Wall Street Journal, 1985).

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Appendix C. Description of PRESTO Model

The MMS develops estimates of undiscovered, economically recoverable hydrocarbons in support of the OCS leasing program. These estimates are used in a number of public and internal documents related to leasing. The EIS's for specific lease sales and events such as the 5-year plan use the estimates as the basis for oil-spill models, sale alternatives, and deferral options, or any other requirement for which the potential resources in specific areas must be known. In Secretarial Issue Documents, estimates of the amounts and locations of potential resources are used by the Secretary of the Interior in balancing the economic benefits of development against the environmental consequences. Estimates provided in the biennial report to Congress are used by the legislature for national strategic and economic planning.

Estimating commercially recoverable amounts of oil and gas remaining to be discovered on the OCS is a difficult task because of the uncertainties inherent in the process. The actual existence of potential hydrocarbon traps or prospects is not known with certainty prior to exploratory drilling. The only information concerning the existence of a potential producing field is derived from inferences, extrapolations, and subjective judgments. Geophysical data provide clues as to the existence and location of possible traps and their general dimensions, but geologic data on the quality of any potential reservoir rocks are usually absent. No data will be available on the nature and distribution of included hydrocarbons, or indeed whether hydrocarbons are present at all. An exact prediction of resource quantities under such circumstances is impossible because the uncertainties in the input data translate to uncertainties in the answers.

However, a methodology that generates estimates under such conditions of uncertainty has been developed and is in current use. The resource estimation process used by MMS incorporates a computer program called Probabilistic Resource Estimates - Offshore (PRESTO). The program uses the types of geological and geophysical data normally used by the oil industry to locate and define potentially hydrocarbon-bearing geologic features. These data are analyzed, interpreted, and eventually refined to a set of input values that numerically model all potential prospects in the study area.

Since these values are rarely exactly known, uncertainty is accounted for by range-of-values estimation; in other words, the inputs for variables can be entered as distributions over a broad range of possible values. The results are also presented as ranges of possible values with associated probabilities of occurrence. The variables used to define potential prospects are

- areal extent (acres);
- zone pay thickness (feet);
- oil recovery factor (stock tank barrels/acre-foot);
- gas recovery factor (thousand cubic feet/acre foot);
- oil share or the proportion of the zone pay thickness consisting of oil;
- solution gas-to-oil ratio (standard cubic feet/stock tank barrel); and
- condensate yield (stock tank barrels/million cubic feet of gas).

Additional required inputs are estimations of minimum economic field size for each prospect and risk values which measure the probability that the prospect or zones within a prospect will be dry and the overall probability that the area may be dry. Minimum economic field sizes are calculated outside PRESTO, usually by another modelling program called MONTCAR. The minimum economic field size is tailored to the prospect, considering factors such as water depth, distance from shore, and depth to the potential pay horizon. It represents the smallest resource amount that would balance development and operating costs and yield a minimum rate of return. PRESTO develops economically recoverable resources by comparing the calculated resource volumes of each prospect to the user-provided minimum economic field size. If the prospect resource volume exceeds the minimum economic field size, the prospect is considered to be economically viable.

Using the above set of inputs as the basis for estimates of resource volumes, the program uses sophisticated sampling techniques to calculate resources. Since each input can be represented by a distribution of values, one point on the distribution for each variable is randomly sampled and the selected values are entered into the volumetric equations to solve for resource amounts. This process is called a "drilling simulation trial" or "pass" and is repeated as many as 5,000 times. On each of these trials, the model "discovers" which prospects will be hydrocarbon bearing by using input risks to simulate drilling of each prospect.

PRESTO calculates volumes of oil, associated and nonassociated gas, condensate, and solution gas for all hydrocarbon-bearing prospects on each trial by the following equations:

1. volume of oil (in barrels) = acres x thickness x oil share x oil recovery factor
2. volume of nonassociated + associated gas (in MMcf) = acres x thickness x (1 - oil share) x gas recovery factor x 0.001
3. volume of condensate (in barrels) = condensate yield x nonassociated and associated gas
4. volume of solution gas (in thousand cubic feet) = gas-to-oil ratio x oil (in barrels) x 0.001

When the specified number of trials is completed, the solutions of each trial are sorted and ranked and the results are defined by distributions of solutions. Thus the full range of possible volumetric solutions is represented by a single curve. This curve is derived from all economic trials, each of which has an equal likelihood of occurrence.

PRESTO calculates conditional resource estimates, the condition being that commercial (economically recoverable) quantities of oil and gas are present in the area of study. In other words, if oil and gas are found in an area, one would expect to find the conditional amount. Since the output of PRESTO is a distribution of resource estimates, for convenience the results are usually reported using only the mean value and the 5th and 95th percentiles. The 5th percentile can be considered a high case where there is a 5-percent chance of that amount or more occurring; the 95th percentile is a low case where there is a 95-percent chance of that amount or more occurring; and the mean is the average value.

Conditional resource estimates are constrained by a number of statistical caveats which defy intuition. PRESTO calculates planning area resource estimates (or any subset such as an alternative sale configuration) by statistically aggregating the estimates of resources in each individual prospect. It does not follow, however, that the total planning area estimate is the arithmetic sum of the prospect estimates. This is so because each prospect has a different condition (i.e., the marginal probability of hydrocarbon occurrence in the prospect). Conditional prospect resources are aggregated to planning area totals by adding the economic resources for all the prospects for a given trial and then averaging the results of all the trials.

However, the condition can be removed by assigning it a numerical value (the marginal probability (MP)). The MP is a decimal fraction and is a measure of the probability that commercial hydrocarbons exist in an area. An MP of 1.00 indicates certainty of commercial occurrence in at least one prospect in the area; an MP of zero indicates no chance whatever. The MP applies to the entire conditional distribution. As an example, consider an area having an MP equal to 0.25. This means that the area has a 25-percent chance of having commercial hydrocarbons exist in at least one prospect in the area. If hydrocarbons do exist, then the conditional distribution represents the expected range of possible values.

Figures 24 and 25 illustrate conditional and risked resource distributions. Cumulative percentages are given on the vertical axis and oil volumes on the horizontal axis. It can be seen on the conditional curve that the 50th percentile corresponds to 2.9 billion barrels of oil (BBO). In other words, there is a 50-percent probability that 2.9 BBO or more would exist if there are commercial accumulations of oil present in the area (the mean or average value to be expected is 2.8 BBO, which corresponds to the 54th percentile in this case). Figure 25 shows the risked distribution of estimates. Note that the risked mean estimate is only 0.7 BBO (0.25 x 2.8). The conditional mean multiplied by the MP yields the risked mean, that is, the average value factoring in the potential risk of no commercial hydrocarbons in the area. However, this is statistically valid only for the mean value; the 5th and 95th percentiles cannot be multiplied by the MP for risked 5's and 95's. (The 5th and 95th percentiles on the conditional distribution will correspond to different percentiles on the risked distribution.)

The risked mean values can be added or subtracted. However, conditional means are not additive; conditional or risked percentile estimates (such as 5th and 95th percentile estimates) cannot be added or subtracted. Risked mean resource values are most useful in comparing different areas for ranking purposes. However, as was mentioned earlier, it is the conditional and not the risked mean that is the amount expected if commercial quantities of oil and gas occur in nature. Table 17 illustrates the essential difference between the two. Two areas have been assessed with very different conditional mean resource bases and marginal probabilities.

The risked mean values calculated for both areas are the same. However, Area A has a larger potential (eight times larger than Area B), with only a small chance (10 percent) of hydrocarbons existing in the area. If Area B contains hydro-

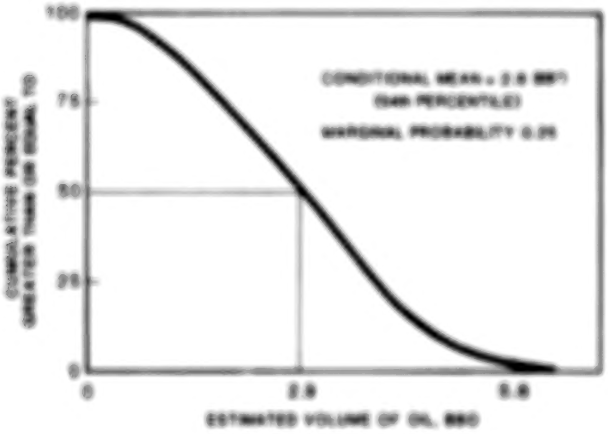

FIGURE 24.--Example of a conditional oil distribution (Cooke, 1985).

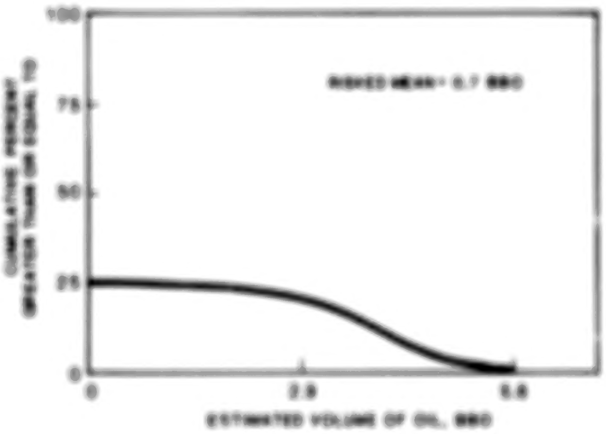

FIGURE 25.--Example of a risked oil distribution (Cooke, 1985).

TABLE 17.—Differences between conditional mean and risked mean resource values in two hypothetical cases

Area	Conditional mean (million barrels)	Marginal probability	Risked mean (million barrels)
A	1,000	0.10	100
B	125	0.80	100

carbons, the amount expected is much smaller, but the chance of hydrocarbons existing in the area is greater (80 percent).

The distinctions between conditional and risked results are further illustrated by the following hypothetical example. A fictitious OCS basin is estimated to contain between 1 and 7 BBO with an average of 3 BBO if oil is present in the basin. However, it is estimated that there is only a 25-percent chance that this condition will be met (oil present in the basin). In other words, if there were 100 identical basins in the world similar to this fictitious basin, 75 would be dry and 25 would contain oil. The 25 basins containing oil would each have between 1 and 7 BBO with the average size being 3 BBO. The average amount found in each of the 100 basins would be reported at 750 million barrels. This is the "risked mean" estimate. Therefore, based on current geologic, engineering, and economic knowledge, if this one fictitious basin is fully explored and oil is found, the amount found will be between 1 and 7 BBO with an average value of 3 BBO. There is, however, only a 25-percent chance of oil being present, so the risked mean estimate is reported at 750 million barrels. In actuality, the amount found (if the models are correct) would be either zero or between 1 and 7 BBO and not the risked mean estimate of 750 million barrels.

The PRESTO resource estimation model is in the process of being upgraded with a number of advanced features. New editions of the program include the capability for a better assessment of unidentified prospects, a microcomputer version of the program, and the use of an improved statistical sampling technique.

Glossary

Definitions presented in this glossary describe terms as they have been used in this summary report. The glossary is intended for general reference only; for detailed descriptions of technical or specialized terms, the reader should seek a reference in the field of particular interest. Abbreviations and acronyms are presented in tabular form on p. iii.

Sources used in compiling this glossary were Office of Outer Continental Shelf Information summary reports and indexes, Webster's Third International Dictionary, the American Geological Institute's Dictionary of Geological Terms, and Langenkamp's Handbook of Oil Industry Terms and Phrases (2d ed.).

Abyssal plains - Flat, nearly level areas that occupy the deepest portions of many ocean basins.

Acoustic and economic basement - Generally, the deepest more or less continuous seismic reflector, often an "acoustic unconformity," below which seismic energy returns are extremely poor to absent. Igneous or metamorphic crustal layer beneath the sedimentary formations and above the moho (Mohorovicic discontinuity). Basement rock does not contain petroleum deposits and therefore may be considered to be the top of the economic basement.

Andesite - A dark-colored, fine-grained extrusive volcanic rock common to convergent plate boundaries.

Anticline - An upfold or arch of stratified rock in which the beds or layers bend downward in opposite directions from the crest or axis of the fold.

Basin - A depression of the Earth in which sedimentary materials accumulate or have accumulated, usually characterized by continuous deposition over a long period of time; a broad area of the Earth beneath which the strata dip, usually from the sides toward the center.

Block - A geographical area of 2,304 hectares (or approximately 9 square miles) used in official MMS protraction diagrams or leasing maps. (See also **Tract**.)

Bonus - Money paid by the lessee to obtain an oil and gas lease.

Butte - A generally flat-topped hill or small mountain with steep slopes or cliffs, often capped with an erosion-resistant layer.

Cambrian - The oldest of the periods of the Paleozoic Era; also the system of strata deposited during that time (between 570 million and 500 million years ago).

Clastic - Consisting of fragments of rocks or of organic structures that have been moved individually from their places of origin.

Cliff and bench topography - A series of bedrock terraces or ledges bounded by steep slopes between valley walls.

Continental glaciation - Global-scale glaciation that originated in polar regions and covered large parts of continents.

Continental margin - A zone separating the emergent continents from the deep sea bottom.

Continental Offshore Stratigraphic Test (COST) well - A well drilled to gather information about the stratigraphic formation present, the general character of the rocks, their porosity, and their permeability.

Continental shelf - A broad, gently sloping, shallow feature extending from the shore to the continental slope.

Continental slope - A relatively steep, narrow feature paralleling the continental shelf; the region in which the steepest descent to the ocean bottom occurs.

Cretaceous - The final period of the Mesozoic Era of geologic time from about 135 million to 63 million years ago.

Deep Stratigraphic Test (DST) well - An official regulatory term referring to a COST well (see **Continental Offshore Stratigraphic Test well**).

Delta - A deposit of sediment formed at the mouth of a river, either in the ocean or in a lake, that results in progradation of the shoreline.

Development - Activities that take place following exploration for, discovery of, and delineation of minerals in commercial quantities (including but not limited to geophysical activity, drilling, platform construction, and operation of all directly related onshore support facilities), and that are for the purpose of ultimately producing the minerals discovered.

Devonian - A period of the Paleozoic Era of geologic time from about 400 million to 345 million years ago.

Diapir - A piercing fold; an anticlinal fold in which a mobile core, such as salt, has broken through the more brittle overlying rocks.

Discovery - The initial find of significant quantities of hydrocarbons.

Drilling mud - A special mixture of clay, water or refined oil, and chemical additives pumped downhole through the drill pipe and drill bit. The mud cools the rapidly rotating bit; lubricates the drill pipe as it turns in the well bore; carries rock cuttings to the surface; serves as a plaster to prevent the wall of the bore hole from crumbling or collapsing; and provides the weight or hydrostatic head to prevent extraneous fluids from entering the well bore and to control downhole pressures that may be encountered.

Economically recoverable resource estimate - An assessment of the hydrocarbon potential that takes into account (1) physical and technological constraints on production and (2) the influence of costs of exploration and development and market price on industry investment in OCS exploration and production.

Environmental analysis - A broad category of environmental reviews or documents required under the National Environmental Policy Act of 1969 (NEPA). If an initial environmental analysis warrants further study, the investigation may proceed to a more formal environmental assessment and, from there, to an environmental impact statement (EIS) or a finding of no significant impact (FONSI).

Environmental assessment - A concise public document required by NEPA, and prepared by a Federal agency, that provides evidence and analysis for determining whether to prepare an EIS or a FONSI.

EIS - A document required by NEPA or similar State law in relation to any action significantly affecting the environment.

FONSI - When the results of an environmental assessment indicate that there will be no significant impact from the proposed activity, a FONSI is issued, and no EIS is required.

Epicenter - The point on the Earth's surface that is directly above the focus of an earthquake.

Exclusive Economic Zone - The belt of water adjacent to the territorial sea and extending to 200 miles in which the Federal Government has exclusive rights and jurisdiction over natural resources.

Exploration - The process of searching for minerals. Exploration activities include (1) geophysical surveys where magnetic, gravity, seismic, or other systems are used to detect or infer the geologic conditions conducive to the accumulation of such minerals and (2) any drilling, except development drilling, whether on or off known geological structures. Exploration also includes the drilling of a well in which a discovery of oil or natural gas in paying quantities is made, as well as the drilling of any additional well after such a discovery that is needed to delineate a reservoir and to enable the lessee to determine whether to proceed with development and production.

Exploration plan - See **Plan of Exploration.**

Fault - A fracture in the Earth's crust accompanied by a displacement of one side of the fracture with respect to the other. (See also **Growth fault**, **Listric fault**, and **Normal fault.**)

Federal Register (FR) - A daily publication (Monday through Friday) distributed by the Superintendent of Documents, U.S. Government Printing Office, that provides a uniform system for making available to the public regulations and legal notices issued by Federal agencies.

Field - An area within which hydrocarbons have been concentrated and trapped in economically producible quantities in one or more structural or stratigraphic reservoirs.

Flysch - Consisting largely of sandy and calcareous shales with beds of sandstone and conglomerate.

Fracture zone - On the deep seafloor an elongate zone of unusually irregular topography that often separates regions of different depths and ages. Such a zone often crosses and apparently displaces the mid-oceanic ridge by faulting.

Geologic trap - An arrangement of rock strata, involving their structural relations or varied lithology and texture, that favors the accumulation of oil and gas.

Geomorphic - Of or pertaining to surface landforms.

Geomorphology - The science of surface landforms and their interpretation on the basis of geology and climate.

Graben - A block, generally long compared to its width, that has been downthrown along faults relative to the rocks on either side.

Growth fault - A fault in sedimentary rock that forms contemporaneously and continuously with deposition, so that the throw increases with depth and the strata of the downthrown side are thicker than the correlative strata of the upthrown side.

Horst - A mass of Earth crust that is limited by faults and that stands in relief with respect to its surroundings.

Hydrocarbon - Any of a large class of organic compounds containing primarily carbon and hydrogen, comprising paraffins, olefins, members of the acetylene series, alicyclic hydrocarbons, and aromatic hydrocarbons, and occurring in many cases in petroleum, natural gas, coal, and bitumens.

Jurassic - The second period of the Mesozoic Era of geologic time from about 190 million to 135 million years ago.

Kerogen - Fossilized insoluble organic material found in sedimentary rocks, usually shales, that can be converted by distillation to petroleum products.

Landfall - The site at which a marine pipeline comes to shore.

Lease - A contract authorizing exploration for and development and production of minerals; the land covered by such a contract.

Lease sale - The public opening of competitive sealed bids offered by companies or individuals for the right to explore for and develop certain minerals within a defined period of time.

Lease term - For oil and gas leases, a period of either 5 years or up to and not to exceed 10 years (the longer leases are awarded when necessary to encourage exploration and development in areas where water is unusually deep or other unusually adverse conditions exist).

Lenticularity - Resembling a curved or lens-shaped cross section of a rock body or sedimentary structure.

Listric fault - A fault that exhibits a curved fracture displacement.

Lithospheric plate - The crust and upper section of the Earth's mantle approximately 100 kilometers deep.

Mafic - Composed dominantly of magnesian rock-forming silicates.

Mesozoic - The era of geologic time from about 225 million to 65 million years ago.

Metamorphic rock - A rock derived from pre-existing rocks generally in response to changes in temperature, pressure, and shearing stress.

Millidarcy - A unit of measure for fluid permeability equalling 0.001 Darcy.

Natural lift - The process by which a reservoir has enough natural pressure to force oil to the surface without pumps, such as the Prudhoe Bay field.

Nautical mile - A measure of marine distance equal to 6,076.11549 feet, or 1,852 meters.

Neritic - Pertaining to the edge of the continental shelf, generally a submerged former beach face.

Normal fault - A fault with a displacement angle between 45° and 90°.

Oil-spill contingency plan - A plan submitted by the oil/gas lessee along with or prior to a submission of a plan of exploration or a plan of development/production that details provisions for fully defined, specific actions to be taken following discovery and announcement of an oil spill. OCS Order No. 7 specifies the requirements of this plan.

Orogen - A belt of deformed rocks, often accompanied by metamorphic and plutonic (igneous) rocks associated with the process of mountain building.

Outer Continental Shelf (OCS) - All submerged lands lying seaward of State offshore lands and landward of the continental margin. Jurisdiction and control over these lands were asserted in 1945 by President Truman. The Truman Proclamations were incorporated into domestic law by enactment in 1953 of the Submerged Lands Act (67 Stat. 29), and the OCS Lands Act (67 Stat. 462).

Overthrust - A low-angle thrust fault of large scale with displacement generally measured in miles.

Paleozoic - The era of geologic time from about 570 million to 225 million years ago.

Permafrost - Any soil, subsoil, or other surficial deposit occurring in arctic, subarctic, and alpine regions at a variable depth beneath the Earth's surface in which a temperature below freezing has existed continuously for a long time.

Petroleum - An oily, flammable bituminous liquid that occurs in many places in the upper strata of the Earth, either in seepages or in reservoirs; essentially a complex mixture of hydrocarbons of different types with small amounts of other substances; any of various substances similar in composition to petroleum.

Petroleum window - The period of time that hydrocarbons may be generated from kerogen if suitable temperature and pressure conditions exist.

Plan of Exploration (POE) - A plan based on all available relevant information about a leased area that identifies, to the maximum extent possible, all the potential hydrocarbon accumulations and wells that the lessee(s) propose(s) to drill to evaluate the accumulations within the entire area of the lease(s) covered by the plan. A POE includes an oil-spill contingency plan and a geohazards and shallow hazards assessment. Under 30 CFR 250 [illegible], all lease operators are required to formulate and obtain approval of such plans by the Regional Director of MMS before exploration activities may commence.

Plate tectonics - A theory of global-scale dynamics involving the movement of many rigid plates of the Earth's crust.

Platform (geol.) - The area of thinner sediments adjoining a geosynclinal wedge of thicker equivalent beds or a basin of thicker equivalent sediments.

Plug - Filling a well's borehole with cement or other impervious material to prevent the flow of water, gas, oil, or other minerals (such as liquefied sulfur) from one strata to another when a well is abandoned.

Prodelta - The offshore part of a river delta that extends below the effective depth of wave erosion and slopes gently down to the floor of the basin into which the delta is advancing.

Production - Activities that take place after the successful establishment of means for the removal of minerals, including such removal, field operations, transfer of minerals to shore, operation monitoring, maintenance, and workover drilling.

Prograded - A seaward advance of the shoreline, resulting from the nearshore deposition of sediments brought to the sea by rivers.

Recoverable resource estimate - An assessment of oil and gas resources that takes into account the fact that physical and technological constraints dictate that only a portion of resources or reserves can be brought to the surface.

Relief - The elevations or inequalities of a land surface.

Reserves - Portion of the identified oil or gas resource that can be economically extracted.

Reservoir - A subsurface volume of rock that has sufficient porosity and permeability to permit the accumulation of petroleum under adequate trap conditions.

Resources - Reserves plus all other hydrocarbon deposits that may eventually become available—either known deposits that are not economically or technologically recoverable at present, or unknown deposits, rich or lean, that may be inferred to exist but have not yet been discovered.

Rifting - Fracturing of the Earth's crust, often associated with extrusion of lava.

Sediment - Material or a mass of material deposited (as by water, wind, or glaciers).

Sedimentary rocks - Rock formed of mechanical, chemical, or organic sediment.

Seismic - Pertaining to, characteristic of, or produced by earthquakes or Earth vibration; having to do with elastic waves in the Earth.

Seismic survey - A method of geophysical prospecting using the generation, reflection, refraction, detection, and analysis of elastic waves in the Earth.

Shelfbreak - An abrupt change in slope, marking the boundary between the continental shelf and the continental slope.

Slump - The sliding down of a mass of sediment shortly after its deposition, especially the downslope flowage of soft, unconsolidated marine sediments, as at the head or along the side of a submarine canyon.

Spud - To begin drilling a well.

Statute mile - A common measure of distance equal to 5,280 feet, or 1,609 meters.

Stratum (pl., strata) - A tabular mass or thin sheet of sedimentary rock formed by natural causes and made up usually of a series of layers lying between beds of other kinds.

Strike - The direction of a horizontal line in the plane of an inclined structural feature such as a rockbed or vein.

Subsidence - Movement in which there is no free side and in which surface material is displaced vertically downward with little or no horizontal component; a sinking of a large part of the Earth's crust.

Tectonic - Of or pertaining to the rock structure and external forms resulting from the deformation of the Earth's crust.

Terrace - A relatively flat, horizontal, or gently inclined surface, sometimes long and narrow, that is bounded by a steeper ascending slope on one side and by a steeper descending slope on the opposite side.

Tertiary - The older of the two geologic periods comprising the Cenozoic Era beginning approximately 63 million years ago and lasting until 5 million years ago; also the system of strata deposited during that period.

Thaw lake - A surface water accumulation that occurs seasonally when the impervious permafrost layer melts to a given depth below ground.

Tract - An areal unit usually consisting of one or more whole or partial blocks from an official protraction diagram. Groups of tracts, having sale-specific numbers, were selected and offered for lease prior to implementation of areawide leasing. (See also **Block.**)

Transgression - Gradual expansion of a shallow sea resulting in the progressive submergence of land.

Trap - A geologic feature that permits the accumulation and prevents the escape of accumulated fluids (hydrocarbons) from the reservoir.

Truncation - The act or instance of cutting or breaking off the top or end of a geologic structure or landform by erosion.

Unconformity - A substantial break or gap in the geologic record where a rock unit is overlain by another that is not next in stratigraphic succession, such as an interruption in the continuity of a depositional sequence of sedimentary rocks or a break between eroded igneous rocks and younger sedimentary strata.

Undiscovered economically recoverable resources - Quantities of economically recoverable oil and gas estimated to exist outside known fields.

Undiscovered in-place resources - Quantities of oil and gas estimated to exist outside known fields, without reference to economic or technological factors.

Unit - Administrative consolidation of OCS leases held by two or more companies but explored, developed, and/or produced by one operator for purposes of conservation, eliminating duplication of operations, and/or maximizing resources recovered.

Uplift - Elevation of any extensive part of the Earth's surface relative to other parts.

Very large crude carrier (VLCC) - A crude oil tanker of 160,000 deadweight tons or larger, capable of carrying 1 million barrels or more.

Well - A hole drilled into the Earth, usually having sides cased with metal pipe, for the production of petroleum.

Wildcat - An oil or gas well drilled in an area not known to be productive.

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PLATES FOR THE ALASKA SUMMARY REPORT

June 1984 - December 1985

The plates accompanying this summary report are found in the pocket opposite.

PLATE 1.--Arctic OCS Subregion

Plate 1 shows the Arctic OCS Subregion planning areas, protraction diagrams, existing leases, and exploratory well locations.

PLATE 2.--Bering Sea OCS Subregion

Plate 2 shows the Bering Sea OCS Subregion planning areas, protraction diagrams, existing leases, exploratory well locations, and COST well locations.

PLATE 3.--Gulf of Alaska OCS Subregion

Plate 3 shows the Gulf of Alaska OCS Subregion planning areas, protraction diagrams, existing leases, exploratory well locations, and COST well locations.

COVER PHOTOGRAPHS

Endicott Development Project looking southeast at Endeavor Island, the Main Production Island, and the causeway to the North Slope coastline (photo courtesy SOHIO Alaska Petroleum Company); Northern fur seals on the Pribilof Islands (photo courtesy NOAA); semisubmersible rig **Ocean Odyssey** drilling an exploratory well in the Navarin Basin during the summer of 1985 (photo courtesy Amoco Production Company).

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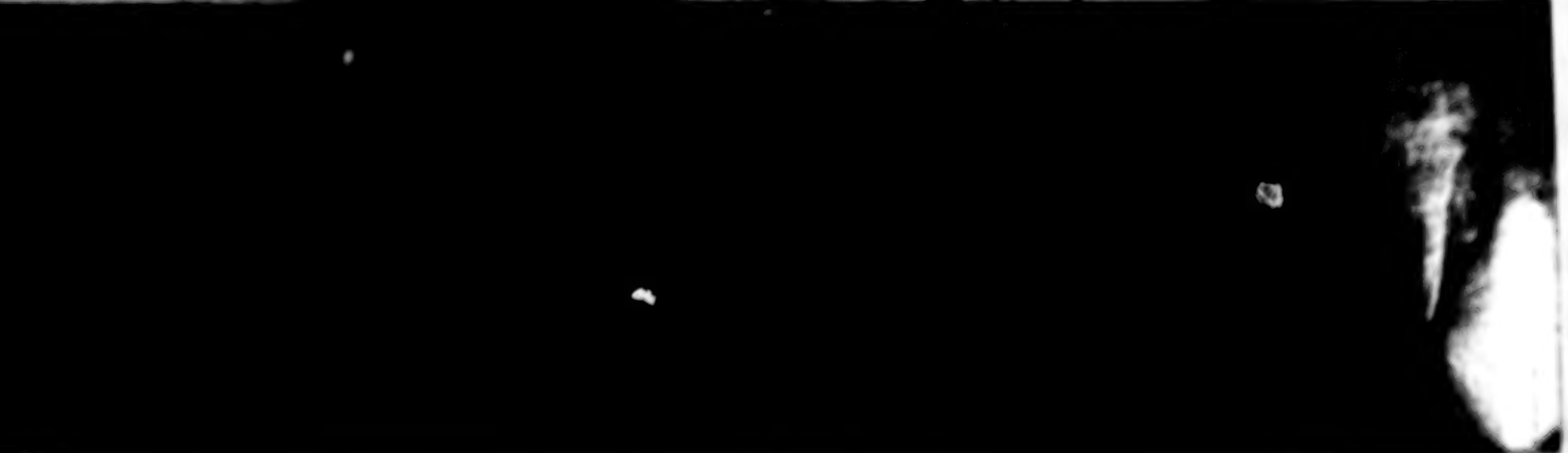

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168°
164°
160°
156°
152°
148°
144°
140°

168°
164°
160°
156°
152°
148°
144°
140°
74°
74°
72°
72°
ARCTIC OCEAN
BEAUFORT SEA
NS 3-7
NS 3-8
NS 4-7
NS 4-8
NS 5-7
NR 5-1
NS 5-8
NS 6-7
NS 6-8
NS 7-7

BEAUFORT SEA
72°
NS 3-7
NS 3-8
NS 4-7
NS 4-8
NS 5-7
NR 5-1
NS 5-8
NS 6-7
NS 6-8
NS 7-7
72°
CHUKCHI SEA
BEAUFORT SEA
Point Barrow
NR 3-1
NR 3-2
NR 4-1
NR 4-2
NR 4-4
NR 5-3
NR 5-2
NR 5-4
NR 6-1
NR 6-3
NR 6-2
NR 6-4
NR 7-1
NR 7-2
NR 7-4
THREE GEOGRAPHICAL MILE LINE
CHUKCHI SEA
NR 4-3
472/473/474
516
560
PRUDHOE
BAY
654
745
744
724
NR 3-3
NR 3-4
70°
NR 7-5
NR 7-6
70°
Point Lay
Colville River
Sagavanirktok River
NR 3-5
NR 3-6
NR 3-8
CANADA
UNITED STAT

PLATE 1
CURRENT ARCTIC OCS LEASING AREA

U.S. Department of the Interior
Minerals Management Service
Alaska Summary Report
(June 1984 – December 1985)

NOTE: The three geographical mile line has been approximated and is not intended to represent a definitive legal boundary.

NOTE: The three geographical mile line has been approximated and is not intended to represent a definitive legal boundary.

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PLATE 2

CURRENT BERING SEA OCS LEASING AREA

U.S. Department of the Interior
Minerals Management Service
Alaska Summary Report
(June 1984 - December 1985)

- ■ Existing lease
- □ Existing lease in disputed area
- ⊕ COST well
- ○ 157 Exploratory well with OCS block number
- ═ Planning area boundary
- NP 1-4 Protraction diagram boundary and number

NOTE: The three geographical mile line has been approximated and is not intended to represent a definitive legal boundary.

Existing lease
Existing lease in disputed area
COST well
157 Exploratory well with OCS block number
Planning area boundary
NP 1-4 Protraction diagram boundary and number
NOTE: The three geographical mile line has been approximated and is not intended to represent a definitive legal boundary.
0 MI 50 100 150 200 250 300
0 KM 50 150 250 350 450
NQ 2-6
NQ 3-5
NOME
NORTON BASIN
NQ 3-7
NQ 3-8
NQ 2-7
NQ 2-8
NORTON SOUND
NQ 4-7
949
COST 1
182
COST 2
267
361
446
NP 4-1
ST. LAWRENCE
NP 1-2
NP 2-1
NP 2-2
NP 3-1
NP 3-2
Yukon River
64°
NP 1-3
NP 1-4
NP 2-3
NP 2-4
NP 3-3
62°
ST. MATTHEW HALL
THREE GEOGRAPHICAL MILE LINE
Kuskokwim River
NP 1-5
NP 1-6
NP 2-5
NP 2-6
NP 3-5
NP 3-7
157
227
ST. MATTHEW ISLAND
NUNIVAK ISLAND
605
637
693
COST 1
NP 60-8
NP 1-7
NP 1-8
NP 2-7
NP 2-8
60°

NP 1-5
NP 1-6
NP 2-5
NP 2-6
NP 3-5
NP 3-7
THREE GEOGRAPHICAL MILE LINE
Kuskokwim
157
227
ST. MATTHEW ISLAND
NUNIVAK ISLAND
NP 60-8
637
693
606
COST 1
NP 1-7
NP 1-8
NP 2-7
NP 2-8
60°
977
414
723
KUSKOKWIM BAY
U.S.-RUSSIA 1867 CONVENTION LINE
NO 60-2
NO 1-1
NO 1-2
NP 2-1
NO 2-2
NO 3-1
NO 3-2
NAVARIN BASIN
ST. GEORGE BASIN
NO 4-3
NO 60-3
NO 60-4
NO 1-3
NO 1-4
NO 2-3
NO 2-4
NO 3-3
NO 3-4
NO 4-4
58°
NO 4-6
BRISTOL BAY
PORT HEIDEN
ST. PAUL ISLAND
NO 60-5
NO 60-6
NO 1-5
NO 1-6
NO 2-5
NO 2-6
NO 3-5
NO 3-6
NO 4-5
NO 4-7
Alaska Peninsula
PRIBILOF ISLANDS
ALEUTIAN BASIN
N. ALEUTIAN BASIN
NO 59-8
ST. GEORGE ISLAND
631
764
711
809
COST 1
NO 60-7
NO 60-8
NO 1-7
NO 1-8
NO 2-7
NO 2-8
NO 3-7
NO 3-8
NO 4-8
56°
NN 3-1
NN 3-2
COST 2
COST 1
604
467
616
Cape Leontovich
NN 4-1
811
NM 59-2
NN 60-1
NN 60-2
NN 1-1
NN 1-2
NN 2-1
NN 2-2
NN 4-2

NO 59-8
NO 60-7
NO 60-8
NO 1-7
NO 1-8
NO 2-7
NO 2-8
NO 3-7
NO 3-8
NO 4-8
ST. GEORGE ISLAND
COST 1
COST 2
Alaska
Cape Leontovich
NN 3-1
NN 3-2
NN 4-1
NN 59-2
NN 60-1
NN 60-2
NN 1-1
NN 1-2
NN 2-1
NN 2-2
NN 3-3
NN 4-2
COLD BAY
BOWERS BASIN
UNIMAK ISLAND
NN 59-4
NN 60-3
NN 60-4
NN 1-3
NN 1-4
NN 2-3
NN 2-4
NN 3-4
NN 4-3
NN 4-4
NN 2-6
NN 3-5
Dutch Harbor
NN 59-6
NN 60-5
NN 60-6
NN 1-5
NN 1-6
NN 2-5
NN 3-6
NN 4-5
NN 4-6
NN 1-8
NN 59-8
NN 60-7
NN 60-8
NN 1-7
NN 2-7
NN 2-8
NN 3-7
NN 3-8
NN 4-7
NN 4-8
NM 1-2
NM 1-1
ALEUTIAN ARC
ALEUTIAN ISLANDS
NM 59-2
NM 60-1
NM 60-2
NM 2-1
NM 2-2
NM 3-1
NM 3-2
NM 4-1
NM 4-2
NM 59-4
NM 60-3
NM 60-4
NM 1-3
NM 1-4
NM 2-3
NM 2-4
NM 3-3
NM 3-4
NM 4-3
56°
54°
52°
50°
NORTH PACIFIC OCEAN

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PLATE 3

CURRENT GULF OF ALASKA OCS LEASING AREA

PLATE 3
CURRENT GULF OF ALASKA OCS LEASING AREA

U.S. Department of the Interior
Minerals Management Service
Alaska Summary Report
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■	Existing lease
⊕	COST well
○ 241	Exploratory well with OCS block number
▬	Planning area boundary
NN 4-6	Protraction diagram boundary and number

NOTE: The three geographical mile line has been approximated and is not intended to represent a definitive legal boundary.

PORT HEIDEN
SHELIKOF STRAIT
KODIAK ISLAND
GULF OF ALASKA
NO 3-6
NO 4-5
NO 4-6
NO 5-5
NO 5-6
NO 6-5
NO 6-6
NO 7-5
NO 7-6
NO 8-5
KSST 2
KSSD 3
KSST 1
56°
NO 3-8
NO 4-7
NO 4-8
NO 5-7
NO 5-8
NO 6-7
NO 6-8
NO 7-7
NO 7-8
NO 8-7
Cape Leontovich
KODIAK
GULF OF ALASKA
NN 3-2
NN 4-1
NN 4-2
NN 5-1
NN 5-2
NN 6-1
NN 6-2
NN 7-1
NN 7-2
NN 8-1
NN 8-2
NN 8-4
UNIMAK ISLAND
NN 3-4
NN 4-3
NN 4-4
NN 5-3
NN 5-4
NN 6-3
NN 6-4
NN 7-3
NN 7-4
NN 8-3
UNITED STATES
CANADA
Dixon Entrance
54°
NN 8-5
SHUMAGIN
NN 7-6
NN 3-6
NN 4-5
NN 4-6
NN 5-5
NN 5-6
NN 6-5
NN 6-6
NN 7-5
52°
NN 3-8
NN 4-7
NN 4-8
NN 5-7
NN 5-8
NM 3-2
NM 4-1
NM 4-2

MICROFILMED FR
BEST AVAILABLE